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5-Year Monitoring Report for Bear Valley Stream and Riparian Habitats

May 1998

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INTRODUCTION

In 1993, the Boise National Forest began an intensive program for monitoring stream and riparian conditions on grazing allotments in the Bear Valley Basin. This monitoring program was designed to address issues related to grazing conflicts between riparian and aquatic habitat for Chinook salmon currently listed as threatened under the Endangered Species Act (ESA). A review of the program was conducted in the summer of 1997 by a team consisting of members of the National Riparian Service Team and the Bear Valley Collaboration Group (NRST 1997). Appendix A contains a list of Review Team members. As a result of this review and subsequent meetings, a refined monitoring strategy was developed and adopted by the end of 1997. The Review Team identified questions and "remaining issues" that needed to be addressed which required an analysis of the monitoring data collected since 1993. This monitoring report uses the monitoring information acquired to date to address these monitoring questions and "remaining issues".

EXECUTIVE SUMMARY

An analysis of the data included in this report as well as general observations by specialists conducting the monitoring, the Review Team and others present a picture of improving riparian and aquatic habitat conditions in the grazing allotments in the Bear Valley Basin. While the data appears to indicate improving conditions, in many cases statistical surety has not been established. In some instances, additional sampling is needed. In other instances, the sampling techniques are not accurate or allow too much variation from observer error, etc. to provide statistically valid results. In others, the annual variability in parameters being measured is so extreme that only very long-term evaluations of trend are possible. The following discussion summarizes data and observations made from 1993 through 1997 relative to the monitoring questions and related issues identified by the Review Team and the subsequent monitoring plan.

When do Chinook arrive to spawn within the Bear Valley/Elk Creek Basin? Observations made since 1941 indicate that early salmon runs may have reached the Basin as early as July 20th. Sixty to seventy-five percent of redds are normally constructed by mid-August. While there is the potential to have conflicts between livestock grazing and Chinook spawning during years when Chinook salmon enter the spawning areas early, conflicts between livestock grazing and Chinook spawning, under current grazing prescriptions, have not been observed. To prevent displacement of salmon during redd construction and potential livestock damage to redds, the Forest will continue monitoring Chinook arrival in the Bear Valley basin at Dagger Falls and upstream of the Bear Valley Bridge. Based on these observations, cattle will continue to be removed from riparian pastures prior to salmon arrival in Bear Valley.

Are livestock present in unauthorized pastures? Current procedures for checking pastures in combination with the use of fences, other improvements, early removal of cattle from riparian pastures, and other elements of the grazing prescription are effective in preventing unauthorized use of Basin pastures, physical disturbance to redds, and displacement of spawning fish during redd building and spawning.

Have new fences been properly constructed and existing fences been properly maintained? Allotment fences have been constructed to Forest standards and are being effectively maintained. Current procedures for monitoring construction and maintenance of fences and other improvements are effective.

Where are the redds located within the Bear Valley/Elk Creek Basin? Current redd locations and densities correspond to historic locations although redd numbers have declined. The use of riparian pastures and exclosures have been effective in eliminating direct impacts to spawning and redds from cattle. If the riparian pasture management prescription for the Stanfield Pasture in the Elk Creek Allotment is changed, it may be possible to predict years where low Chinook spawning activity exists within Elk Creek above Porter Creek. During those years of low spawning activity within this portion of the drainage, protection of individual redd locations may be possible. However, this would depend upon intensive in season monitoring of salmon and redd construction and rapid response by the permittee to move livestock away from areas with unprotected redds.

What is the long-term trend of the Bear Valley salmon population? (This question was inadvertently left out of the December 17, 1997 Monitoring Plan and has been added to the updated 1998 Monitoring Plan.)

Redd counts throughout the basin have shown a steady decline since the 1950's. Peak years exist but not with good predictability. Figure 1 shows the trend in redd counts for Bear Valley Creek and Elk Creek. The spawner replacement ratio, shown in Figure 3, is used as an indicator of habitat productivity. The trend shows that in the long-term (pre 1985) the population is declining and in the short-term (post 1985) there is no clear trend.

What is the trend in baseline water temperature? Water temperature criteria for Chinook spawning & incubation were exceeded 1.3% of the time, or approximately 1.5 days during the summer in the lower reaches of Bear Valley and Elk Creeks. Temperature flux from upstream to downstream through individual pastures was small, ranging from an average 1.3 degree C increase through Big Meadows exclosure, to a 0.8 degree C decline through the Bear Valley riparian pasture. There is a strong correlation for these stream reaches between water temperature and air temperature.

To what degree does channel width-to-depth ratio and shading (canopy cover) effect water temperature? The Forest will continue to monitor width-to-depth ratios and to use Hobo temperature thermographs to monitor temperature at the long-term trend stations. Canopy cover (shading) measurements along the main stem segments of Bear Valley and Elk Creeks will be discontinued because collected data does not show a correlation between width-to-depth ratio or shading for these broad, meandering stream reaches. A stronger correlation between these factors can be expected in smaller tributary streams, therefore additional long-term trend monitoring stations will be established on tributaries important for bull trout spawning/rearing. Canopy cover, temperature and width-to-depth monitoring will be implemented at these stations. The densiometer technique will be used to estimate canopy cover (shading). Additionally changes in vegetation and woody species on these stream banks will be monitored.

What intensity of bank sloughing/breakdown occurs as a result of cattle being present on the pastures? Observations of stream bank alteration due to livestock trampling and trailing declined significantly from 1993 to 1997 in riparian pastures and the Stanfield unit. The greatest improvement has been observed in the Bear Valley riparian pasture, where rates exceed even those of the ungrazed areas. These observations suggest that current livestock use levels are allowing unstable channels and stream substrates to recover. As recommended by the Review Team, a modified approach to bank sloughing/breakdown has been developed. Using the

modified process to assess direct in-season stream bank alteration from cattle trampling and trailing impacts to stream banks reduces monitoring time by over one half.

What are the trends in bank stability? Although most stations do not yet show statistically significant trends in bank stability, the data generally show stable to improving trends. The interagency Review Team determined that recovery of these riparian systems would be long-term. In the short-term, they would show significant affects from high bed loads. Additionally, the annual runoff events for the years 1994 - 1997 and their impact on bank stability have been highly variable. These facts when added to the potential for measurement error contribute to the high variability observed in the samples, which makes it difficult to establish statistically significant trends in bank stability. Other aquatic/riparian ecosystem factors may be more indicative of trends in riparian and aquatic ecosystem health. The determination of trends for factors such as ecological status or condition of riparian vegetation, width/depth ratios, and surface fines will give better information about ecosystem recovery and health. The reliance on measurement of bank stability should be reduced. For the short-term, however; annual year end monitoring of bank stability at the long-term trend sites will be continued.

What level of stream bank utilization is occurring? Utilization measurements have shown livestock grazing to consistently be within established standards. Enough experience has been gained by monitoring utilization since 1992 to validate that the grazing prescriptions meet these standards. As a result, utilization monitoring intensity can be reduced, however; measurements should continue to be made to assure compliance with the utilization standard. Additionally, grazing utilization measurements will be made at the end of the year at the long-term monitoring stations.

Measuring percent utilization is similar to measuring stubble height. Utilization monitoring will continue to use percent utilization measurement techniques. In-season utilization monitoring will continue in the short-term with more emphasis on ocular monitoring techniques.

What are the trends in stream bank riparian vegetation? In 1994, 50 percent of the long-term stations were in late seral or potential natural community (PNC) ecological status. In 1997, 87 percent of the stations were in late seral or PNC ecological status. Observations and general appearance of all units and exclosures support the overall indication shown by the data that the ecological status of stream bank plant communities is improving. However, statistically significant trends (based on P>F values) in vegetation ecological status were found at only two sites which are located in the Bear Valley Riparian Pasture. Annual year end monitoring of bank stability at the long-term trend stations wll be continued.

The methodology for monitoring woody riparian species has not been effective for assessing trends. The Woody Species Regeneration methodology will be dropped and the Modified Step-Point Transect methodology will be used for evaluating trend of woody species. These transects will be run along the same length of stream banks which are sampled at the long-term trend stations for bank stability and vegetation ecological status. This includes new long-term trend stations which will be established on tributaries where they will also be used as part of the process for evaluating shading (water temperature) .

What are the trends in surface fine sediments? Levels of substrate fine sediments are generally decreasing through time. The data suggest that substrate conditions are generally improving in the salmon/steelhead spawning stream reaches associated with historically grazed riparian

areas. In the Bear Valley riparian pasture 13 of 14 stations show declines, and the downward trend at station BV-5B is statistically significant. All grazing units showed declines in substrate fines while the relatively undisturbed reference site (at Crane Meadow) showed little or no change during the 5 year period.

Wolman Pebble Counts and Grid measurements of surface fines should both continue to be used in future monitoring. Because of the high annual variability, and the importance to the recovery of Chinook/steelhead productivity, this parameter will be sampled annually at the long-term trend stations.

What are trends in depth fines? Over entire period of time (1976-96) for monitoring program for depth fines the trend is inconclusive. Recent data (1990-present) suggest substrate conditions are on an improving trend. The recent trends in depth fines are most likely attributed to stream improvement projects and changes in implementation of management activites. It is recommended this monitoring activity continue biennially until 2000 to see if a statistically significant trend results.

What are the trends in pool abundance? From the data collected over the last 5 years, there is indication of a positive trend in pool frequency, however; the increases are not statistically signigicant. Pool frequency is an important parameter in defining fish habitat quality and stream function. Changes in pool frequency, in the absence of a catastrophic event, usually occur over long periods of time. Pool frequency will be monitored on a 3 - 5 year frequency.

What are the trends in both pool and channel width/depth ratio? Trends in width-to-depth ratio are generally insignificant. Overall mean R^2 for channel width/depth and pool width/depth ratio were 0.37 and 0.40 respectively. Average slope of the regression lines was -0.69 (channel W/D ratio), and -0.45 (pool W/D ratio). The negative slope indicates that channels and pools are narrowing and/or deepening. Significant improving trends were observed at BV2A and BV2C, in the Poker/Ayers exclosure, BV5B and BV6B in the Bear Valley riparian pasture, and E2B in the Stanfield Unit. The lack of a clear trend at all sites might be partly due to the fact that water level stage was not annually calibrated. The establishment of cross-section profiles in 1997 and future monitoring of this parameter will provide water level stage information needed to make the appropriate adjustments.

What are the trends in visual indicators? Photo monitoring has been an effective assessment procedure that supports the general appearance of improving riparian and aquatic habitat trends in the Bear Valley Basin allotments. Additional photo points will be established at station monuments and selected point bars at long-term monitoring stations. A selected group of previously established photo points at the allotment compliance monitoring stations will also be monitored annually.

I. REDD COUNTS

Monitoring question: **When do Chinook arrive to spawn within the Bear Valley/Elk Creek Basin?**

Monitoring Method, Frequency, Duration

Monitor daily at Dagger Falls; 2 times per week in Bear Valley. Protocol: Visually observe at Dagger Falls each evening beginning July 1st. After first observation of fish jumping Dagger Falls, arrival in Bear Valley is approximately 2 weeks. At that time, commence 1 mile walk-throughs each of Bear Valley and Elk Creeks.

Historic records, personal observations, and information from redd counts were combined to identify approximate dates for Chinook arrival in the Bear Valley Basin.

Findings

Redds were observed as early as late July to as late as mid September. The 1941 survey by the U.S. Fisheries Service observed spawning activity and redds on July 28. The 1987 Idaho Fish and Game survey, conducted on July 27, observed redds already constructed. Personal observations (Monte Miller) indicate that early salmon runs have hit Dagger Falls as early as July 4th and Bear Valley by July 20th. Other personal observations (Don Corely) indicate that salmon generally did not enter into tributaries above Dagger Falls (such as Camas Creek) until late July. Approximately 60-75% of the redds were observed in the basin by mid August.

Conclusions

From the information presented above, it appears that there is potential to have conflicts between livestock grazing and Chinook spawning during years when Chinook salmon enter the spawning areas early. Cattle are generally moved out of the pasture by July 21 and although highly unlikely, it is possible that Chinook could enter the lower portions of the Bear Valley Basin by that time.

In order to ensure that cattle are not present when spawning occurs, salmon arrival is monitored initially below Bear Valley at Dagger Falls. Once salmon are observed at Dagger Falls monitoring will start two weeks later in Elk Creek or Bear Valley Riparian Pasture. As soon as salmon are observed in the Elk Creek or Bear Valley Riparian Pasture, cattle are moved. This strategy should resolve any potential conflicts. As a result of this strategy, conflicts between livestock grazing and Chinook spawning have not been observed during the last 4 years.

Recommendations for Monitoring

Continue monitoring Chinook arrival in the Bear Valley basin by visually observing for Chinook arrival at Dagger Falls and upstream of the Bear Valley Bridge. Approximately two weeks after Chinook salmon are observed at Dagger Falls, start walk-throughs in the Bear Valley and Elk Creek riparian pastures to determine the presence of adult salmon and move livestock when salmon are observed or at the end of the three week grazing period for the pastures.

Monitoring question: Where are the redds located within the Bear Valley/Elk Creek Basin?

Monitoring Method, Frequency, Duration

In primary production habitat subject to livestock use, monitor once when moving through riparian pastures between upland units, monitor again before livestock gain access, and again after redd construction. Protocol: Standard redd survey.

Red counts were conducted from early August to mid September. Usually two surveys were conducted annually. The first was conducted early in the season (mid August) to record redds that would not be visible in mid September. The second survey was conducted in mid September after spawning was complete. Observations were made by walking along streams and recording redds, based upon the type and size of gravel disturbance. Not all the redds recorded where actually mapped. Therefore, red locations serve to identify the stream reach where spawning activity occurs but not necessarily the individual location of all redds reported.

Redd locations observed over the last 5 years were compared to historical observations from fish surveys conduced in July 1941 by the Bureau of Fisheries and in August 1987 by the Idaho Department of Fish and Game. Observations from local residents were also used. Observers recorded salmon selecting the shallow head of riffles (tail-out of pools) for redd construction.

Findings

Specific information on redd locations and trends are summarized below:

Elk Creek

The 1941 survey characterized the lower portion of Elk Creek as having numerous sand bars and large quantities of pea gravel, sand, and silt. Few redds were observed within this portion of the stream. The 1941 survey characterized the portion above twin bridges a having several beaver dams/dens and willow/brush banks. The 1941 survey ended at the confluence of Porter Creek, but made reference to redds observed in Elk Creek 2-3 miles above Porter Creek. The 1987 survey identified 68 redds from the mouth of Elk Creek to Twin Bridges and 81 redds from the Twin Bridges to the fork of west fork and east fork of Elk Creek. Map 1 shows the historic areas of spawning, as identified in the 1941 and 1987 surveys.

Surveys since 1993 show that areas of low or high redd densities correspond to observations made in 1941 and 1987. Map 2 shows the redd locations recorded in Elk Creek from 1993-1997. Current redd locations and densities appear to correspond to historic locations although redd numbers have declined within portions of the drainage. Information for all 5 years from the upper portion of Elk Creek above Porter Creek is limited. High redd densities were recorded in 1993. Although not mapped, salmon were seen above Porter Creek in 1997 (personal communication, Steve Yondt, 1997).

Bear Valley Creek and Tributaries

The 1941 and 1987 surveys provide the primary source of historical information within Bear Valley Creek. Historic reports of salmon spawning provided an indication of the amount of

spawning within Bear Valley Creek and adjacent tributaries. It appears that salmon redds historically were well distributed along Bear Valley Creek from the confluence of Elk Creek through the lower 2/3's of the drainage. Little spawning has been documented within the tributaries of Bear Valley Creek. References to salmon spawning in Fir Creek were made in the 1941 survey. Personal observations from Forest Service employees also indicate limited spawning in Fir Creek. The 1941 survey also indicated no salmon observed spawning within Cache Creek and Coyote Creek. Survey notes also make reference to local public input indicating no salmon spawning within Cache Creek and Coyote Creek. The 1987 survey in Bear Valley Creek showed 54 redds from Fir Creek to the mouth of Elk Creek; 38 redds from the mouth of Elk Creek to Cub Creek, and 10 redds from Cub Creek to the Porter Bros. Dredge site. Map 3 shows the historic areas of spawning based upon historic observations.

Map 4 shows the redd locations recorded in Bear Valley Creek from 1993-1997. Current redd locations and densities correspond to historic locations although redd locations have declined within portions of the drainage.

Monitoring Question: What is the long-term trend of the Bear Valley salmon population? (This question was inadvertently left out of the December 17, 1997 Monitoring Plan and has been added to the updated 1998 Monitoring Plan.)

Monitoring Method, Frequency, Duration

The Idaho Fish and Game conducts redd counting every year. This data is used to determine salmon population trend.

Results

Redd counts throughout the basin have shown a steady decline since the 1950's. Peak years exist but not with good predictability. Figure 1 shows the trend in redd counts for Bear Valley Creek and Elk Creek. The spawner replacement ratio, shown in Figure 3, is used as an indicator of habitat productivity. When the ratio is above 1, the population is growing, and when the ratio is below 1 , the population is declining. The trend shows that in the long-term (pre 1985) the population is declining and in the short-term (post 1985) there is no clear trend.

Conclusions

Elk Creek

All redds within the Elk Creek drainage from the mouth of Elk Creek to Twin Bridges are protected by a riparian pasture. Livestock grazing is timed to occur during the period salmon are not in the drainage. Redds within the Stanfield Unit above Twin Bridges are currently not protected. Information on the amount and year to year variability of redds within Elk Creek above Porter Creek is limited. Some recent years show little to no redds within the upper portions of Elk Creek while other years (1993) show substantial redds within the upper portion of Elk Creek. Historically, this portion of the drainage appeared to receive more consistent annual spawning. During the last 4 years, livestock grazing in the Stanfield United only occurred prior to salmon entering the drainage.

Bear Valley

Currently, all redds recorded within the Bear Valley Creek drainage are protected from potential livestock trampling by either an exclosure or riparian pasture. In addition, the data indicates that the current placement of exclosures and riparian pastures protects historic spawning areas.

Recommendations for monitoring

1. Mapping redd locations serve primarily to identify the stream reach where spawning activity occurs, whereas counting the number of redds can indicate the relative strength of the salmon population over time. While annual redd counts should be continued, mapping of redd locations need only be done during peak years or a minimum of once every 5 years, thus capturing the maximum length of stream reach where spawning activity is occurring.

2. It may be possible to identify years where low Chinook spawning activity exists within Elk Creek above Porter Creek. During those years of low spawning activity within this portion of the drainage, protection of individual redd locations may be possible. However, this would depend upon intensive in season monitoring of salmon and redd construction and rapid response by the permittee to move livestock away from unprotected redds. The Bear Valley Collaborative Group has scheduled a summer field trip and this item will be put on the agenda for further discussion.

Figure 1: Redd counts in Bear Valley/Elk Creek Basin

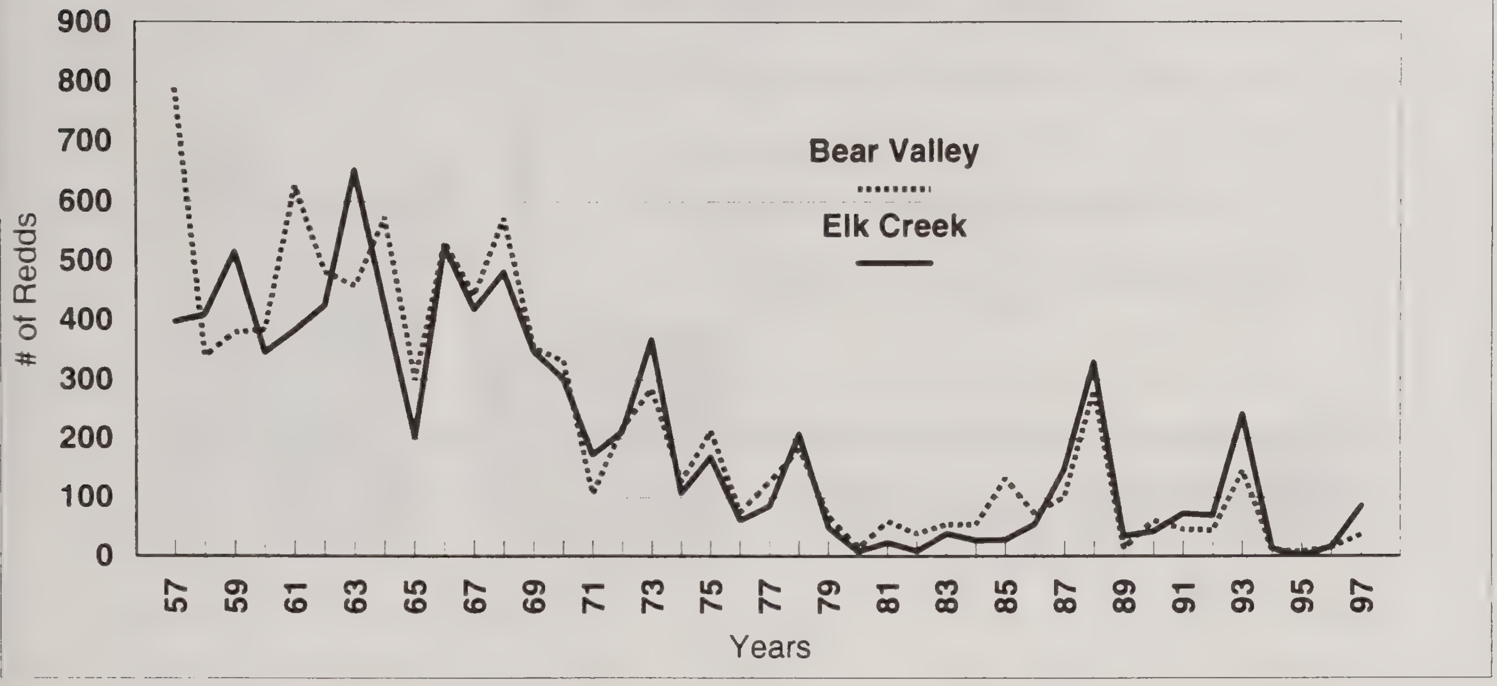


Figure 2: Spawner Replacement Ratio

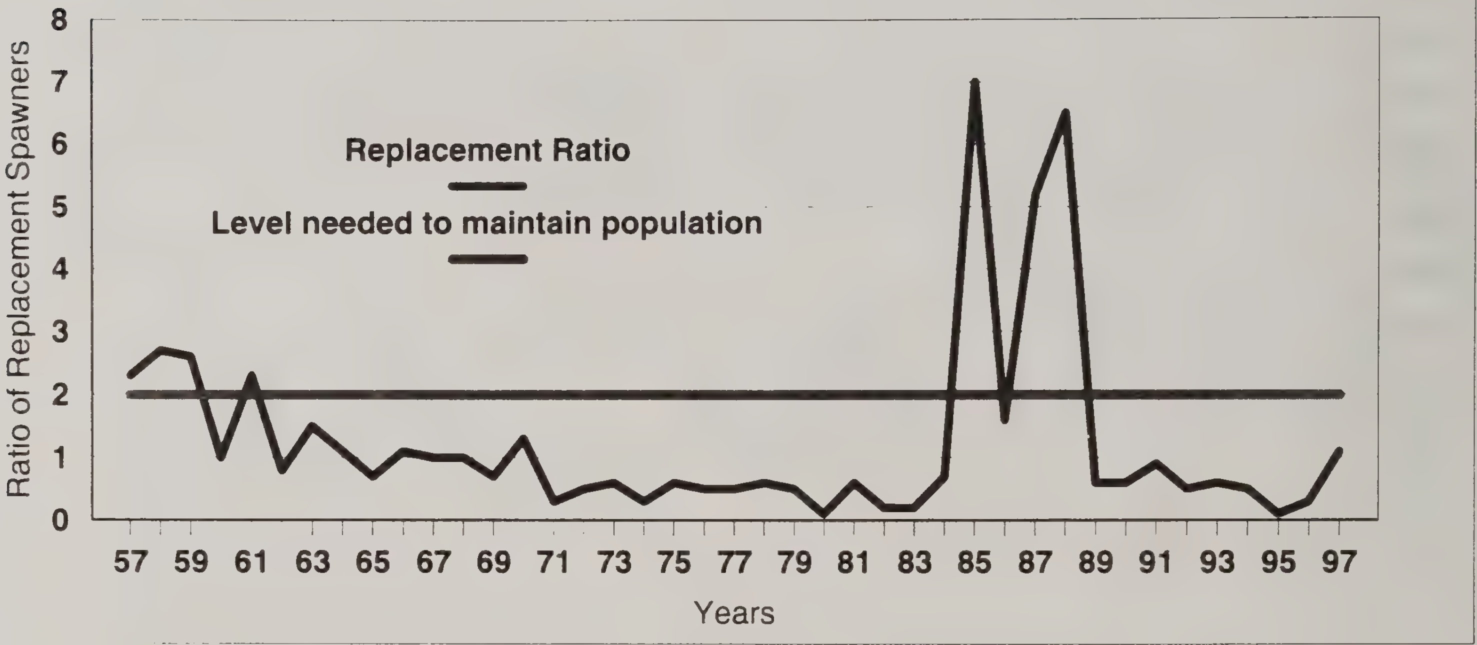
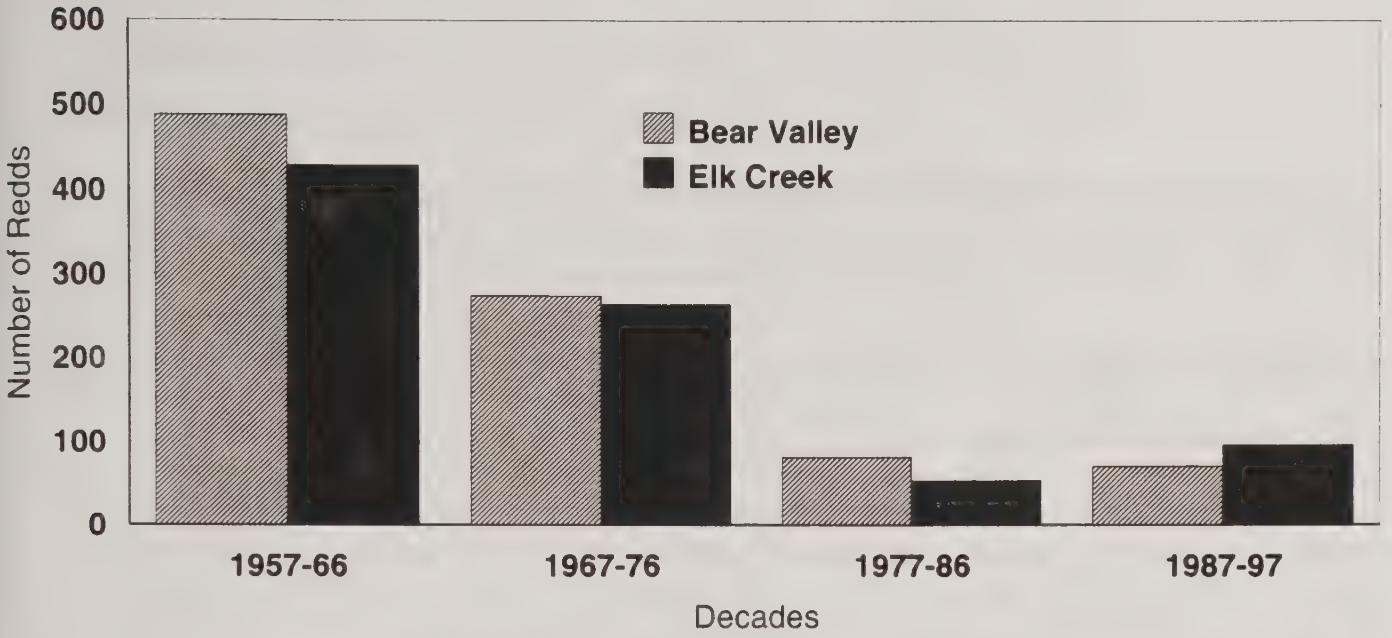


Figure 3: Ten Year Average of Chinook Redds Within The Bear Valley/Elk Creek Basin



II. ALLOTMENT MANAGEMENT

Monitoring question: Are livestock present in unauthorized pastures?

Monitoring Method, Frequency, Duration

Monitor pastures adjacent to active units, two times weekly. Protocol: Walk/ride/drive - greater intensity in unfenced pastures. Permittee responsible to monitor livestock. Forest conducts incidental checks.

The allotment pastures in the Basin allotments have been established through a combination of fencing and the use of natural barriers to livestock movement. The exclosures have been constructed using various types of fencing. It is not economically feasible to construct sufficient barriers to provide 100 percent certainty that livestock will not be able to get through fences or barriers into units at inappropriate times. The grazing permittees periodically check pastures to ensure that cattle are kept out of units per directions stated in the grazing prescriptions. Forest employees also frequently check the pastures to ensure that the grazing prescription is being followed. This is especially important for the riparian pastures and exclosures once spawning has begun.

Findings

There have been some instances of cattle getting into riparian pastures and occasionally the exclosures after spawning had begun. The checks made by the herders and the Forest have been effective in quickly removing cattle when this has occurred. There was only one observed instance when cattle may have impacted redds. This occurred in the Stanfield Unit of the Elk Creek Allotment in 1993. After this occurrence, the grazing prescription was altered to keep cattle out of the unit after redd construction began to ensure that it would not happen again.

Conclusions

Current procedures for checking pastures in combination with the use of fences and other improvements, early removal of cattle from riparian pastures, and other elements of the grazing prescription are effective in preventing unauthorized use of pastures, physical disturbance to redds, and displacement of spawning fish during redd building and spawning.

Recommendations for Monitoring

Continue current procedures including using herders and Forest personnel to monitor livestock getting into riparian pastures and exclosures at unauthorized times. Current procedures are effective and no change is warranted.

Monitoring question: Have new fences been properly constructed and existing fences been properly maintained?

Monitoring Method, Frequency, Duration

Monitor pastures with fences, once each season prior to grazing. Protocol: New construction, maintenance pre-grazing by either permittees or Forest (according to terms of permit).

All fences, whether constructed under contract, by the grazing permittees or the Forest were inspected at the time of construction and found to meet Forest standards. All grazing permits in the Basin identify maintenance responsibility for fences and other improvements related to livestock grazing.

Findings

Forest personnel regularly check fences in the grazing units to insure that they are properly maintained and functional before livestock are placed in the respective grazing unit. These inspections show that appropriate construction and maintenance procedures are being followed.

Conclusions

Allotment fences have been constructed to Forest standards and are being effectively maintained.

Recommendations for Monitoring

Current procedures for monitoring construction and maintenance of fences and other improvements are effective.

III. WATER TEMPERATURE

Summer water temperatures have been monitored along the primary Chinook production stream reaches since 1993, using continuous recording Hobo thermographs. The thermographs have been programmed to record water temperature every 90 minutes (18 measurements per day) from about July 1 through September 30 each year. Thermographs have been located to detect temperature changes associated with changes in channel cross section in addition to measuring the effect of changes in riparian management on water temperature. Isolating the effect of annual climatic variations was accomplished by calibrating water temperatures to the 5-year mean air temperature, as recorded at the closest SNOTEL station, Banner Summit.

Monitoring question: What is the trend in baseline water temperature?

Monitoring methods, Frequency, Duration

Monitor upstream/downstream of pastures, recorded on 90 minute intervals. Protocol: Hobo temperatures monitoring water and ambient air.

Findings

Temperature summaries for grazing units are shown in Table 1, including a description of the percent of time spawning and rearing criteria for Chinook salmon were exceeded. Because the loser the lower reaches of Bear Valley and Elk Creek are broad, meandering streams, they were expected to exceed spawning criteria during summer days. Maximum temperatures were reached about 1.3% of the time or approximately 1.5 days during the summer. Temperature flux from upstream to downstream through individual pastures was small, ranging from an average 1.3 degree C increase in Big Meadows exclosure to a 0.8 degree C decline in the Bear Valley riparian pasture.

Monitoring question: To what degree does channel width-to-depth ratio and vegetation cover affect water temperature?

Monitoring methods, Frequency, Duration

Monitor long-term monitoring stations on tributaries, 3-5 year intervals. Protocol: Bankfull width/depth, modified pace woody species canopy cover transect, canopy densiometer, hobo temperatures.

Information on water width-to-depth ratio and canopy cover has been collected at the long-term monitoring stations, located proximal to the temperature monitoring sites, since 1994. The techniques for measuring channel cross-sectional profile have recently been augmented by surveyed profiles (see Section X - Channel Width/Depth Ratio).

Monitoring of canopy shade was initiated at the long-term monitoring stations in 1994. Canopy cover measurements have been made at each habitat unit within monitoring reaches using the densiometer reading method described by Platts and others (1987). This is the standard method for determining canopy cover used elsewhere on the Boise National Forest. Recent intensive evaluations of this technique, both to estimate its effectiveness in assessing shade potential and its relation to water temperature, have validated the technique (Allison and McIntyre, in press).

These investigations concluded that: 1) there is no advantage to using either a concave or convex densiometer in estimating canopy cover, 2) instream canopy cover using the Platts et. al. method works well to approximate water temperature, 3) instream canopy cover approximates water temperature more accurately in riffle habitats than at pools, and 4) instream canopy cover correlated better with water temperature than did solar input when assessing average water temperatures over time.

Findings

Comparisons of year-to-year mean water temperatures, width-to-depth ratios, and canopy cover are shown in Table 2. Canopy cover was seldom, if ever recorded at the monitoring stations owing to their broad water widths and low-growing vegetative cover, typical of the meadows in Bear Valley.

Recommendations for monitoring

Based on the findings, the following monitoring protocols are recommended for assessing temperature and shade:

1. Continue to use Hobo temperature thermographs at 90 minute setting.

2. Locate thermographs at the following stations: BV2A, BV2C, BV3A, BV7A, BV8A, E1A, E2A, E2B, Porter, Dagger, Ubrskn, EFelk, Fir. The location are established upstream and downstream of grazing units and on tributaries important for bull trout spawning/rearing.

3. Discontinue canopy cover measurements within the mainstem segments of Bear Valley and Elk Creeks, but establish and maintain canopy cover measurements within the tributaries, where canopy has some influence. Canopy cover should be monitored at established (staked) locations to maintain repeatability. Currently the long-term monitoring stations are each staked at 6 locations along the streambanks. Monitoring at these locations should be repeated at 3 year intervals.

4. The densiometer technique should be used to estimate canopy cover at each of the staked locations in each monitoring station. This technique is time-efficient and has been validated as an adequate estimate of stream shade.

Table 1. Temperature summary for primary chinook production stream reaches in Bear Valley by grazing unit (1993 data).

Unit	Station	Mean Summer Temp. C	Upstream to Downstream Change C	% exceedance spawning criteria	% exceedance rearing criteria
Big Meadows	BM1	9.1		1.09%	0.19%
Exclosure	BM5	7.8	1.3	0.75%	0.17%
Bear Valley	BVRP1	9.5		1.21%	0.24%
Riparian Pasture	BVRP5	10.29	-0.79	1.47%	0.31%
Elk Creek	ERP1	12		2.22%	0.22%
Riparian Pasture	ERP6	11.2	0.8	1.72%	0.28%
Poker/Ayers	PA4	12.1		2.37%	0.45%
Exclosure	ERP1	12	0.1	2.22%	0.22%
Bruce Meadow	CLD	6.87		0.30%	0.00%
Cache Creek	LCACHE	9.49		0.99%	0.11%
Reference	LFIR	7.17		0.05%	0.00%
Averages		9.77	0.24	1.31%	0.20%

Table 2. Temperature comparisons to channel width and cover in Bear Valley, by grazing unit.

Unit	Station	Mean Summer Temp. C	Upstream to Downstream Change C	Average width to depth ratio	Average width to maximum depth ratio	Canopy cover %
Big Meadows	BM1	9.1				
Exclosure	BM5	7.8	1.3	15.93	7.48	0
Bear Valley	BVRP1	9.5				
Riparian Pasture	BVRP5	10.29	-0.79	36.42	12.55	0
Elk Creek	ERP1	12				
Riparian Pasture	ERP6	11.2	0.8	23.41	6.30	0
Poker Ayers	PA4	12.1				
Exclosure	ERP1	12	0.1	27.48	9.52	0
Reference	LFIR	7.17		22.76	5.42	0

IV. IN-SEASON BANK STABILITY

Monitoring question: What intensity of bank sloughing/breakdown occurs as a result of cattle being present on the pastures? What is the appropriate monitoring protocol and standard for in-season streambank alteration/stability?

Monitoring Method, Frequency, Duration

Monitor primary production habitats (allotment monitoring stations) once every two weeks while livestock are present. Protocol: Needs further evaluation; will investigate modified Platts bank alteration method and verify based on alteration data that has already been collected.

Findings

The purposes of monitoring bank stability during the grazing season are two-fold: 1) to evaluate effects of livestock grazing on short-term changes in bank stability and 2) to serve as a trigger for removal of livestock from the pasture prior to excessive streambank alteration. Avoidance of excessive streambank alteration is intended to prevent bank breakage into the stream which introduces fine sediment which may be transported onto redds. Such sedimentation may locally reduce ingravel survival of incubating salmon. It is not known how much bank sloughing actually smothers incubating eggs because the hydraulic complexities of aggradation and degradation integrated with channel morphology and grade are so highly variable along stream reaches that modeling has not been practical.

In the past, bank stability changes were measured within grazed pastures and compared to controls (exclosures) to determine if sloughing was excessive. Statistical tests were made to determine if the difference between treatment and control sites were significant. These tests, if positive, were used to trigger livestock movement from the grazed pasture. However, in-season bank stability has never triggered a move. An interagency review of the method in 1997 concluded that: This approach has been unsuccessful because stream reaches within the control and treatment areas are often at different stages of channel evolution and may have different processes influencing streambank stability (i.e. bedload) (National Riparian Service Team 1997). While visiting Bear Valley, members of the Review Team observed that stream channels were in varying states of stability, with more stable channels apparent higher in the system, and large bedloads and instability more pronounced lower in the system. These observations are supported by actual measurements of bank stability made over the years at monitoring stations basin-wide: Mean 5-year bank stability at allotment monitoring stations in the upper reaches of Elk Creek is 63% , and 53% in the lower reaches. Likewise on Bear Valley Creek, mean bank stability is 72% in the upper reaches and only 56% in the lower reaches adjacent to the Bruce Meadow.

Over long periods of time in the stream environment, fluvial processes operate through gradual adjustments, to evolve stable stream channel forms. This tendency toward stability has been variously referred to as self-stabilization (Rosgen 1994), dynamic equilibrium (Wolman 1955), or steady state (Strahler 1952). Such a stable stream channel has reached a proportional balance between sediment load, discharge, and stream gradient. In general, both erosion and deposition are minimized (Morisawa 1968). Channel condition is controlled by the straighteness or sinuosity of the channel, and the resistance of banks and beds to erosion (Morisawa 1968).

In meadows like those in Bear Valley, erosional resistance is strongly influenced by the character of the riparian vegetation. As historic disturbances of grazing and mining altered vegetative resistances to erosion, the channel became destabilized after experiencing lateral erosion and channel widening. This upset the balance between erosion and deposition, introducing higher sediment loads into the system, and reducing sediment transport efficiencies. The result was increased deposition of fine sediments on the bed of the stream where critical salmon incubation and rearing occurs. Pools became shallower in depth, and as banks sloughed away, hiding places beneath them were lost. The heavy bedloads of sand were gradually transported downstream.

The Review Team observed that stream channels historically degraded by vegetative disturbance, as described in the previous paragraph, are now recovering. Such recovery is beginning to restore the erosion/deposition balance and thus the stability of the channel. This recovery seems to be progressing at higher rates in the upper system where stream energies are lower and sediment loads from upstream are smaller. Lower in the system bedloads are still high and channel stabilities are appear much more depressed. There is apparently a strong gradient of channel condition along the lengths of recovering stream channels in the basin. Therefore exclosure stream reaches, located either low or high in the basin, are not good comparisons for much of the grazed area. Both grazed and excluded stream reaches are strongly influenced by bedloads from upstream, and it may not be possible to find a truly representative exclosure. For these reasons, the Review Team proposed that the in-season bank stability protocol and standard be modified. If actual streambank alteration attributable to direct trampling/trailing of livestock was measured, there would not be the need for a comparison to controls. Using this approach, in-season streambank stability monitoring would focus on that portion of stability attributable to short-term trampling effects and separate the long-term aspects from the protocol. Long-term monitoring sites need to continue and are addressed in Sections IV and VI to be assessed using the previously established classification protocol.

Streambank alteration by cattle trailing and trampling has been evaluated at the allotment monitoring stations since 1993. These data are used to evaluate the effectiveness of the approach and to recommend an appropriate monitoring protocol.

Streambank Alteration

Streambank alteration directly attributable to livestock trampling/trailing was first monitored in the 1993 grazing season (Kozel and Burton 1993). The protocol, though refined slightly in subsequent years, has been applied every year since that time. At each of the in-season monitoring stations, the observer was required to record any evidence of trampling or trailing by livestock likely to have caused bank destabilization or loss of cover. This was based on a technique described by Platts and others (1987) and referred to as artificial streambank alteration. These authors point out that distinguishing between natural and artificial alterations can be difficult. It is possible that trampling and trailing observations could be made where banks are already naturally altered and vise versa. Thus observers are directed not to record a trampling/trailing if there is any doubt. The method used by Platts and others (1987) method rated the bank at a point and did not incorporate lineal measurements. Thus they found that, overall precision (repeatability) using this approach was good, but accuracy (actual measures) were lacking. We therefore refined the method to include actual measurements of unstable bank length attributable to trampling and trailing by livestock.

A summary of streambank alterations, by year, are included for each station (Table 3). Observations of trampling/trailing associated with bank instability were infrequent and incidental.

Exclosures (Big Meadows and Poker/Ayers) had the least amount of observed alteration. These units generally experienced less than 1 percent bank alteration, and what little was observed occurred in 1993, right after the exclosures were first constructed. Observations of trampling and trailing in the exclosures may have been due to either trespass livestock or elk. Elsewhere, bank alterations attributable to livestock trampling/trailing were never greater than 8.2 percent of total unit bank length, in any given year, and 3.8 percent over all five years. Alterations at individual stations ranged from 1 percent of the bank length at BV-2 in 1993 to as high as 51% at E-3 in 1993. Overall, riparian pastures fared slightly better than upland pastures (Bear Valley and Elk Riparian pastures 1.8% and 2.0% respectively, versus Sheep Trail/Bruce Meadows and Poker/Ayers Units 3.8% and 2.5% respectively). Very low levels of trampling/trailing generated bank alterations were observed in the Stanfield Unit (0.5%).

Observation of streambank alteration due to livestock trampling and trailing declined from 1993 to 1997 in riparian pastures including the Stanfield unit (Figure 4). In 1997 field crews were specifically instructed to record all evidences of cattle or human trailing/trampling influences on bank instability. None were reported within the riparian and Stanfield units in 1997.

Streambank alteration standard (trigger for moving livestock): The most recent Biological Opinion (May 1997) concludes that continued compliance with the bank stability standard is needed to minimize the incidental take of listed salmon (page 10). That standard requires moving cattle off of the Bear Valley riparian pasture, the Elk Creek riparian pasture, and the Stanfield unit when bank stability decreases at monitoring stations in those units exceed the average decreases of bank stability within the Poker/Ayers and Big Meadows exclosures. As indicated above, findings of the Review Team concluded that such exclosure comparisons would be inappropriate. This finding invalidates the existing standard.

In describing action-specific effects in the 1993 Biological Opinion (pages 16 - 18), the NMFS clearly articulated its intent in establishing a bank stability standard for livestock grazing. The new standard was expected to assure that streamside grazing would not directly reduce streambank condition or maintain streambank stability at depressed levels. It was not certain that the 25% grazing utilization standard would be adequate to provide this assurance. It was believed that controlling grazing use would avoid direct alteration from trampling/trailing, and indirect alteration from modification of the stable, deep-rooted plant communities that respond slowly to grazing pressures.

The grazing strategy put in place in 1993 has consistently achieved the utilization standards within riparian pastures, and monitoring data indicate that this is allowing recovery of vegetation, streambank cover, vegetation ecological status, and woody stem regeneration. These improvements in vegetation are meeting NMFS' desired effect on indirect influences of cattle on streambank stability. The monitoring results described above also clearly show that direct streambank alteration by trampling and trailing has declined to near zero under the current grazing regime. These results indicate that the 25% utilization standard is removing adverse cattle influences on bank instability.

In view of the fact that the grazing utilization standard achieves increased composition of hydric vegetation and decreased trampling/trailing alterations (to near zero), it is recommended that the streambank stability standard be dropped and that the trigger for moving cattle off of the units be based soley upon the utilization standards. Monitoring of streambank alteration within the grazing season would be used to assure that the positive relationship of bank alteration to utilization

is real. Any adverse modifications to streambank stability observed during the period when cattle are present in a grazing unit would be assessed for cause and effect, and if needed the utilization standard or period of use would be re-addressed.

Recommendations for monitoring in-season streambank alteration

Power analyses were used on the existing data to estimate the sample size needed for predicting bank alteration within each grazing unit. One sample represented one 30 meter reach of streambank in the power analysis. Results of the analysis indicated that approximately 30 samples would be needed to estimate the true mean (power = 0.90, alpha = 0.05). Using both sides of the stream, 2 samples would be collected from within one 30 meter stream reach. Thus 15, 30-meter reaches would be needed to adequately sample mean bank alteration (450 meters total from 15 independent sites). Existing in-season monitoring stations, which were selected by random stratification over the length of stream within each grazing unit, should continue to be used to collect these data, so that trends may be monitored. Only grazed units would be monitored.

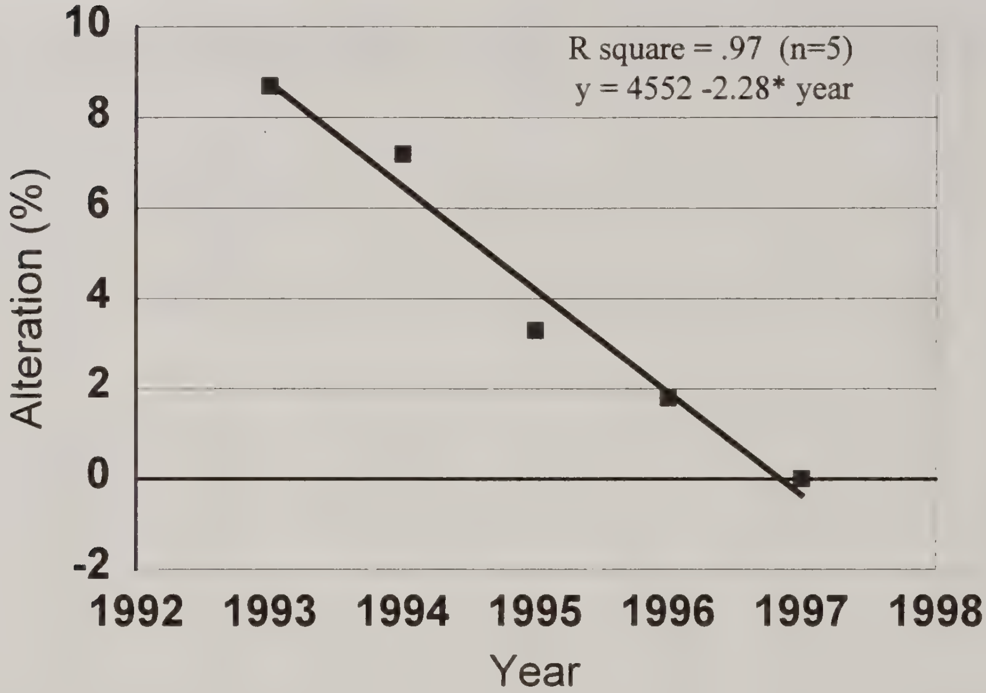
At each station, the observer would collect utilization data at the streambank adjacent to the vegetation cage, according to the present protocol (see section V). Visual observations along the existing monitoring stream reach would be made to see if any fresh signs of cattle trampling/trailing are evident. If so, the observer would record the length of unstable streambank attributed to the disturbance. Only the following streambank stability categories would be recorded: CU, UU, US, UB (uncovered bar). The length of trampled bars would be identified and recorded separately. The observer would also record the kind of disturbance (TL - cattle trailing, TP - cattle trampling). Presently, there are 7 in-season monitoring stations in each of the riparian pastures and the Stanfield unit. To obtain 15 samples, an additional 30 meter reach should be evaluated near 6 of the stations, and two additional reaches near the other station. The location, upstream or downstream from the existing reach should be randomly selected. The observer would simply proceed to the identified stream reach and search for signs of cattle disturbance, recording the lengths of associated bank instability. At the end of the survey, 30 lengths of stream bank (15 on each side of the stream) would have been assessed in each grazing unit. The 30 samples would monitor approximately 1000 meters of streambank in each unit.

This new approach allows assessing more than twice the existing amount of streambank at much reduced time and expense. Stations would not be monitored unless cattle are present. Existing in-season stations within exclosures and the beaver-flooded reaches along Bearskin Creek, would be eliminated from the evaluation. Stations in the Stanfield unit, not currently scheduled for grazing, would not be visited. Time-consuming wading along and measuring entire lengths of streambank would also be eliminated. It is estimated that the time required to evaluate the streambank at any one station would be reduced in half (this includes the addition of a 30 meter reach at each site for bank alteration assessment). The total number of stations would also be reduce by approximately one-half (from 55 to 26), and even fewer (18) if the Stanfield unit is not grazed. Monitoring would be focused on primary production stream reaches, however several existing tributary stations within the riparian pastures and Stanfield unit would continue to be monitored.

Table 3. Annual summary of streambank alteration at in-season monitoring stations based on direct observations of trampling and trailing from 1993 through 1997.

UNIT	YEAR	UNIT LENGTH	STATION NAME	STATION LENGTH	LENGTH TRAMPLED	STABILITY CLASS	% OF STATION	% OF UNIT
BM	1993		BM-2	65.5	1.5	US	2%	0.5%
Total		328			1.5			0.1%
BM/Cache	1994		CS-1	57	1	CU	2%	0.4%
	1995		M-1	63	3	CU	5%	1.3%
	1996		M-1	63.5	17	CU	27%	7.5%
Total		228			21			1.8%
BVRP	1993		BV-2	51	0.5	UU	1%	0.1%
	1996		BV-2	52	1	CU	2%	0.1%
	1995		BV-3	70	6	CU	9%	0.9%
	1995		BV-5	80.5	15	UU	19%	2.2%
	1994		BV-7	62.5	7	UU	11%	1.0%
	1993		S-2	54	2	UU	4%	0.3%
	1995		S-2	48.5	1.5	CU	3%	0.2%
	1996		S-2	48.5	11.5	UU	24%	1.7%
	1993		ST-1	60.5	16	CU	26%	2.4%
Total		671.5			60.5			1.8%
ST BRMD	1996		ST-2	48.5	1	CU	2%	0.6%
	1995		CD	56	3.5	CU	6%	2.1%
	1994		CB-1	56	1.5	CU	3%	0.9%
	1995		CB-1	58.5	12	CU/UU	21%	7.3%
	1996		CB-1	59	13.5	CU/UU	23%	8.2%
Total		164.5			31.5			3.8%
ERP	1993		E-1	62	2	CU	3%	0.4%
	1993		E-3	48.5	24.5	UU	51%	4.6%
	1994		E-3	48.5	24	UU	49%	4.5%
	1993		E-5	57.5	1	CU/UU	2%	0.2%
Total		528			51.5			2.0%
STAN	1994		SU-5	72.5	9	UU	12%	1.7%
	1993		PR	189.5	3.5	UU	2%	0.7%
Total		526.5			12.5			0.5%
POK AYR EXCL	1993		PA-1	67.5	2.5	US	4%	1.0%
Total		259.5			2.5			0.2%
POKER/ AYERS	1993		PA-5	54.5	13	CU/UU	24%	2.5%
	1993		AY-2	55	1.5	CU	3%	0.3%
Total		115.5			14.5			2.5%

Figure 4. Average streambank alteration in riparian pastures attributable to trampling/trailing by livestock



V. LONG-TERM BANK STABILITY

Monitoring question: What are the trends in bank stability?

Monitoring Methods, Frequency, Duration

Bank stability has been monitored at sixteen long-term monitoring stations in the Bear Valley and Elk Creek Allotments since 1994. The monitoring technique used to evaluate bank stability is a modification of the method described by Platts and others (Platts, et.al. 1983). This method is described in the Riparian-Stream Ecosystem Analysis, A Guide to Watershed/Fisheries Field Evaluations (WFE), Boise National Forest (USDA, USFS. 1996) with the exception that the length of stream bank sampled was not restricted to 50 meters of stream. The length of the bank stability transects was set to coincide with in-stream parameter measurements made at these stations. In total, approximately 3400 meters of stream bank are evaluated for bank stability at these long-term trend stations.

Findings

In 1997, the bank stability monitoring procedure was reviewed in the field by the National Interagency Riparian Service Team. As a result of this review, the definition of bank stability on sand and gravel bars was changed (NRST, 1997). Data collected from 1994 through 1996 was modified to reflect the definition change and allow for comparison of data for evaluation of trends in bank stability. Bank stability (in percent) is displayed in Table 4.

Changes in bank stability are the result of many factors, such as bed load, annual variations in runoff, climatic events, etc. Analysis of all of these factors needs to be considered when evaluating the data displayed above. One significant factor is the physical effect of livestock trampling stream banks. This is displayed and analyzed in Section IV In-season Bank Stability. Changes in stream bank riparian vegetation are displayed and analyzed in Section VII Riparian Vegetation. Spring runoff is a significant factor that is not displayed or analyzed in this report. The amount, timing and duration of runoff and associated flows has very significant effects on bank stability. Spring flows in the Spring of 1997 had significant effects on bank stability. Numerous changes occurred which significantly affected measurements made in 1997. For example the site EC2B has one side of the stream protected by brush revetments. Spring flows in 1997 washed around the revetments and scoured out a significant portion of the bank. This resulted in lower bank stability measurements.

Regression analysis (SAS Institute Inc. 1995) was used to assess trends in bank stability. The results of this analysis is displayed in Table 5. Trend statistics include an analysis of R^2, P>F, and slope of the regression. R^2 describes the proportion of the variation around the mean percent bank stability which is explained by the linear regression model. An R^2 value of 1 describes a perfect fit for the model, describing a trend that is an accurate representation of the change in the sampled data. The closer the R2 value is to 1, the better the fit. P>F, the probability of F, evaluates the probability that the trend is real as compared to natural variations in the ecosystem. The smaller the value for P>F, the greater the likelihood that the trend is real. A P>F value of 0.05 or less is considered strong evidence of trend. The slope of the trend line estimates the overall rate of change in percent bank stability. A positive slope represents an improving trend in bank stability. Statistics are shown in Table 5.

A significant trend (P>F of 0.05 or less) occurred only at one site, BV6B. Overall, 9 sites have regression fits with positive slopes indicating improving trends in bank stability. Seven sites show decreasing trends. Bank stability is improving in the Bear Valley Riparian Pasture, the Elk Creek Riparian Pasture, and the Poker/Ayers Exclosure. The Stanfield Pasture and Big Meadows show decreasing trends in bank stability. The two sites in the Stanfield Pasture have not been grazed since 1995. Site BV7B in the Big Meadows Exclosure has not been grazed since 1992. Site BV8A in the Big Meadows Exclosure has not been grazed since 1986.

Conclusions

Statistically significant trend (based on P>F values) in bank stability is displayed only at one site, BV6B, which is located in the Bear Valley Riparian Pasture. The trend at this site is improving at the rate of 6% per year. Observations and general appearance of the Elk Creek Riparian Pasture, the Bear Valley Creek Riparian Pasture and the Poker/Ayers Exclosure support the indication shown in the above data that bank stability is improving in these units (see photographs included at the end of this report).

The declining trends observed at seven stations may be attributed in part to sampling variability and stream movement associated with current bed load. One outcome of the review made by the National Interagency Riparian Service Team in 1997 was an observation that recovery of these riparian systems would be long-term. During this time, they would show significant stream movement and other affects from high bed loads. Also, the annual runoff events for the years 1994 - 1997 and their impact on bank stability have been highly variable. These facts when added to the potential for measurement error contribute to the high variability in the samples .

Recommendations for monitoring

As stated above, recovery of riparian systems is a long-term process, and that in addition to the natural variation within aquatic systems makes it difficult to establish statistically significant trends in bank stability. Other aquatic/riparian ecosystem factors may be more indicative of trends in ecosystem health. If statistically significant trends are established for factors such as ecological status of riparian vegetation, width/depth, and surface fines; reliance on measurement of bank stability could be reduced. For the short-term, annual year end monitoring of bank stability at these long-term sites needs to be continued.

Table 4 Bank Stability (% of length)

Unit	Station	1994	1995	1996	1997
Elk Creek Riparian	EC1A	78.3	65.5	87.7	85.2
	EC1B	75.5	66.0	82.3	84.5
Stanfield	EC2A	71.0	77.7	83.9	67.5
	EC2B	93.6	74.5	90.2	49.0
Bear Valley Riparian	BV3A	38.0	42.6	71.4	66.5
	BV3B	56.4	65.2	82.8	68.9
	BV5A	82.3	70.7	82.7	66.5
	BV5B	55.6	51.3	79.7	no data
	BV6A	32.4	22.0	51.7	34.1
	BV6B	71.2	76.0	86.7	88.1
	BV7A	59.3	46.0	58.9	52.0
Big Meadows Exclosure	BV7B	65.3	77.8	70.6	65.6
	BV8A	98.7	98.0	99.5	86.6
Poker/Ayers Exclosure	BV2A	49.1	49.7	32.6	34.6
	BV2B	52.0	47.3	58.5	51.3
	BV2C	41.3	47.0	79.3	66.3
Average		54.9	52.1	64.3	54.3

Table 5 **Trend Statistics for Bank Stability**

Unit		Station	P>F	R^2	Slope
Elk Creek	**Riparian**	EC1A	0.44	0.31	4.29
		EC1B	0.33	0.45	4.33
	Average		0.39	0.38	4.31
Stanfield		EC2A	0.92	0.01	***-0.43***
		EC2B	0.25	0.56	***-11.81***
	Average		0.58	0.29	***-6.12***
Bear Valley	**Riparian**	BV3A	0.12	0.77	11.43
		BV3B	0.35	0.42	5.51
		BV5A	0.44	0.31	***-3.54***
		BV5B	0.42	0.62	12.05
		BV6A	0.63	0.13	3.48
		BV6B	**0.04**	**0.93**	**6.14**
		BV7A	0.82	0.03	***-0.9***
	Average		0.40	0.46	4.88
Big Meadows	**Exclosure**	BV7B	0.86	0.02	***-0.63***
		BV8A	0.26	0.54	***-3.48***
	Average		0.56	0.28	***-2.06***
Poker/Ayers	**Exclosure**	BV2A	0.15	0.73	***-6.06***
		BV2B	0.75	0.06	0.09
		BV2C	0.21	0.62	10.73
	Average		0.37	0.47	1.59
All Stations	**Average**		0.46	0.38	1.95

VI. STREAMBANK UTILIZATION

Monitoring Question: What level of streambank utilization is occurring?

Monitoring Methods, Frequency, Duration

Streambank utilization measurements or estimates have been monitored on 51 allotment compliance monitoring stations since 1992. These monitoring sites are located on both primary production (mainstem) streams and their tributaries on the Bear Valley, Elk Creek, and Deer Creek allotments. The reasons for monitoring streambank utilization are two-fold: 1) to evaluate effects of livestock grazing in relation to other parameters, such as bank stability and cover, and 2) to serve as a trigger for livestock management changes in a pasture or grazing unit.

Findings

Streambank utilization standards are designed to maintain or improve bank stability, cover, and greenline ecological status, at the same time leaving enough stubble height on the residual vegetation to trap sediment. Since 1992, there have been several monitoring techniques implemented to measure streambank utilization in an attempt to find an accurate, efficient, and consistent method.

The last 3 years, a utilization cage was placed on the greenline (line of perennial vegetation closest to the stream) on the dominant plant community at each monitoring station. When possible, the cages were located within 1 meter of the streambank. Utilization, using the ocular estimate by plot method, was monitored at the same time intervals as streambank stability and cover. Two transects of 10 plots each, one transect on each side of the stream along the greenline, were read in community types similar to that in the utilization cage. At each plot, the forage utilization was recorded as falling into one of the following vegetative utilization classes:

(a) no use (0-5%)
(b) slight use (6-20%)
(c) light use (21-40%)
(d) moderate use (41-60%)
(e) heavy use (61-80%)
(f) severe use (81-100%)

For each category, the total number of sites falling into that category was multiplied by the midpoint of the utilization range for that category. The totals from all categories were added and divided by 20 to give average utilization for that station.

Utilization is calculated as the average (mean) utilization for each category (primary production or tributary) for each allotment unit. As specified in the previous biological assessments, if the standard for a category within an allotment unit is exceeded, the Lowman District has 2 days to notify the permittees and the permittees have 7 days from the date they are notified to remove the cattle from the unit.

Streambank utilizations in the three Bear Valley allotments are summarized in Tables 6-8.

Conclusions

Streambank utilization monitoring is an effective tool in evaluating the current livestock management objectives. It will continue to be used as a trigger in order to make livestock management adjustments. Under the current utilization standards, the aquatic objectives (decrease substrate fines and increase instream edge cover) and the grazing objectives (upward trend toward attainment of streambanks) will be accomplished (see photographs included at the end of this report). Since the grazing management prescriptions were partially implemented in 1992 and fully implemented in 1993, the utilization monitoring measurements have been consistently within established standards.

Recommendations

Data collected since 1992 and the review by the National Riparian Service team in 1997, indicates season-of-use or the amount of time cattle are grazing in any given pasture, is adequate to ensure that utilization levels are not exceeded. Periodic occular estimates will be continued when cattle are grazing in a unit and used to make adjustment in livestock management if necessary.

There has been some discussion of using stubble height instead of utilization. Since they are similar in the results or objectives to be met, it is proposed to continue with utilization in the short-term to be consistent with previous years' monitoring. Also in the short-term, it is proposed that ocular estimates are made at the end of the year at the long-term monitoring stations to compare with the other parameters being measured, such as bank stability, cover, and ecological status.

Table 6 Bear Valley Allotment - Streambank % Utilization Summary

Unit	Station	1992	1993	1994	1995	1996	1997
Bear Valley Riparian Pasture	BV-1	25	7	4	10	7	2.5
	BV-2	44	7	9	25	17	3.5
	BV-3	13	15	27	12	17	2.5
	BV-4	29	7	31	31	23	2.5
	BV-5	27	7	20	17	10	2.5
	BV-6	10	3	15	13	4	3
	BV-7	35	2	36	23	3	12.6
	Primary Average	26	7	20	19	12	4
	ST-1	33	3	4	11	3	2.5
	S-1	50	5	0	11	17	2.5
	CC	14	8	16	15	4	18.5
	S-2		15	10	24	23	6.5
	Tributary Average	32	8	8	15	12	8
	Unit Average	28	7	16	17	12	5
Big Meadows Cache Creek *	BM-1 (exclosure)	30	2	0	3	4	2.5
	BM-1A (exclosure)		0	0	3	3	2.5
	BM-2 (exclosure)	36	2	10	3	3	2.5
	BM-3 (exclosure)	25	3	5	6	5	2.5
	BM-4 (exclosure)	25	2	3	4	3	2.5
	BM-4A (exclosure)		2	0	4	5	2.5
	BM-5 (exclosure)	0	2	0	3	4	2.5
	Primary Average	23	2	3	4	4	3
	CS-1		25	47	40	26	25.7
	UCC	45	0	10	27	34	36.1
	M-1		75	40	38	41	39.3
	Tributary Average	45	33	32	35	34	34
	Unit Average	27	11	12	13	13	12
Sheeptrail Bruce Meadows **	ST-2	33	3	5	34	33	18.3
	CB-1		10	28	42	32	34.7
	CD (exclosure)	56	75	51	12	0	3
	WY	20					
	Tributary Average	36	29	28	29	22	19
Allotment							
	Primary Average	25	4	11	11	8	3
	Tributary Average	36	22	21	25	21	19
	Combined Average	29	12	15	17	13	10

* Exclosures constructed in 1992 and implemented in 1993.

** Exclosure constructed in 1994 after reaching the desired utilization standard and constucted prior to grazing in 1995, 1996, and 1997.

Table 7 Elk Creek Allotment - Streambank % Utilization Summary

Unit	Station	1992	1993	1994	1995	1996	1997
Elk Creek Riparian Pasture	E-1	10	25	25	6	4	2.5
	E-2	40	30	5	10	7	2.5
	E-3	33	8	9	3	3	2.5
	E-4	30	25	0	4	3	2.5
	E-5	15	20	13	5	5	3.5
	E-6	5	15	0	5	3	3.5
	Primary Average	22	21	9	6	4	3
	ERP-BS	0	8	0	4	4	2.5
	CKC-1	25	20	29	3	3	8.8
	Tributary Average	13	14	15	4	4	6
	Unit Average	20	19	10	5	4	4
Stanfield Unit	SU-1	37	40	29	25	9	
	SU-2	36	30	19	41	4	
	SU-3	0	35	23	16	3	
	SU-4	16	40	47	31	4	
	SU-5	47	35	26	39	3	
	Primary Average	27	36	29	30	5	
	SU-6	60	35	0	24	3	
	PR		5	4	4	5	
	Tributary Average	60	20	2	14	4	
	Unit Average	33	31	21	26	4	
Poker Ayers *	PA-1 (exclosure)	15	3	0	5	12	
	PA-2 (exclosure)	20	3	0	5	3	
	PA-3 (exclosure)	35	3	0	3	6	
	PA-4 (exclosure)	0	8	12	5	4	
	Primary Average	18	4	3	5	6	
	PA-5	40	75	61	45	4	43.1
	AY-1	17	15	50	18	3	22.9
	AY-2	17	15	44	14	5	16.8
	Tributary Average	25	35	52	26	4	28
	Unit Average	21	17	24	14	5	28
Allotment							
	Primary Average	23	21	14	14	5	3
	Tributary Average	27	25	27	16	4	19
	Combined Average	24	22	18	14	5	10

* Exclosures constructed in 1992 and 1993 and implemented in 1993.

Table 8 Deer Creek Allotment

Streambank % Utilization Summary

Unit	Station	1992	1993	1994	1995	1996	1997
Bearskin	BS-1	1					
Little	BS-2	25	3	0	5	7	
Beaver	BS-3	13	0	0	14	6	
	BS-4	50	0	10	14	3	
	LB	13	10	2	26	5	
	Tributary/Unit Average	20	3	3	15	5	

Outside Allotments

Streambank % Utilization Summary

Unit	Station	1992	1993	1994	1995	1996	1997
Outside	FR						
Allotments	DR		9	5	10	3	
	Tributary Average		9	5	10	3	

VII. RIPARIAN VEGETATION

Monitoring Question: **What are the trends in stream bank riparian vegetation?**

Monitoring Methods, Frequency, Duration

Trends in stream bank riparian vegetation has been measured using two protocols established by the Intermountain Region of the Forest Service (USDA, USFS, 1992). These protocols measure the ecological status of riparian vegetation and the regeneration of woody species on stream banks and bars.

Results

The ecological status of riparian vegetation has been monitored at sixteen long-term monitoring stations in the Bear Valley and Elk Creek Allotments since 1994. These measurements are made along the same transects as bank stability (Section V). Ecological status is a measurement of the present state of vegetation and soil protection of an ecological site in relation to the potential natural vegetative community for the site. It is an expression of the relative degree to which the observed plant community resembles the potential natural community for the site (USDA, USFS 1992). The intermountain Region of the Forest Service (R-4) has defined riparian plant communities for significant portions of Idaho, Wyoming, Utah and Nevada (Manning, et.al. 1995; Padgett, et.al. 1989; Youngblood, et.al. 1985; Weixelman, et.al. 1996). Additional information collected on the Boise National Forest from 1994 - 1997 was used to modify Regional data (USDA, USDI. 1996). The ecological status for each site is determined by dividing the amount of stream banks occupied by late seral riparian plant communities by the amount of the banks that would be occupied by these plant communities in their undisturbed or potential natural community (PNC) condition. These are grouped and described as:

<41%	Early Seral
41% - 60%	Mid Seral
61% - 85%	Late Seral
>85%	PNC

In 1997, the bank stability monitoring procedure was reviewed in the field by the National Interagency Riparian Service Team. As a result of this review, the definition of bank stability on sand and gravel bars was changed. This change affected the location of the samples along portions of the sites. Data collected from 1994 through 1996 was reviewed and where appropriate adjusted to reflect the definition change and allow for comparison of data for evaluation of trends in ecological status.

Table 9 displays the ratings for riparian vegetation ecological status calculated from field transects repeated from 1994 through 1997. The data shows a definite shift to riparian plant communities composed of stronger, deeper rooting plant species associated with stable stream banks.

As discussed in Section V, the amount, timing and duration of runoff and associated flows has very significant effects on bank stability. When meanders change, sections of bank are washed away along with their associated plant communities and in other locations streambanks are being deposited with early seral plant communities. Spring flows in the Spring of 1997 had significant

effects of this type relecting a significant amount of erosion and depositional changes along the streambanks. For example the site EC2B has one side of the stream protected by brush revetments. Spring flows in 1997 washed around the revetments and scoured out a portion of the bank behind the revetments. This resulted in moving the vegetation sample location into a different riparian plant community with a lower ecological condition rating.

Regression analysis (SAS Institute Inc. 1995) was used to assess trends in bank stability. The results of this analysis is displayed in Table 10. Trend statistics include an analysis of R^2, P>F, and slope of the regression. A thorough discussion of each of the trend statistic can be found in Section V.

Conclusion

Statistically significant trends (P>F of 0.5 or less) are found at only two sites, BV3A and BV6B, both located in the Bear Valley Riparian Pasture. The trends at these sites are improving at the rate of approximately 18% and 14% per year respectively. Twelve of the 16 sites show a positive trend in ecological status, which means that the streambanks are moving toward a late seral or potential natural community condition. Four of the sites are depositional in nature, moving toward an early or mid seral stage.

Overall, both data and visual observations indicate the ecological status of streambank plant communities is improving. In 1994, 50% of the sites were in late seral or PNC ecological status. In 1997, 87% of the sites were in late seral or PNC ecological status. Thus 37% of the vegetation communities have moved into a more stable condition, supporting more of the deep rooted plants, which in turn improve streambank stability. Visual observations of all units and exclosures support the data that the ecological status of stream bank plant communities is improving (see photographs included at the end of this report).

Statistically significant trends (based on P>F values) in ecological status are displayed only at two sites, BV3A and BV6B, both located in the Bear Valley Riparian Pasture. The trend at these sites are improving at the rate of approximately 18% and 14% per year respectively. While not statistically significant, four sites show negative slopes for the fitted regressions (decreasing trends in ecological status). These sites are EC2B (discussed above) in the Stanfield Unit, BV5A in the Bear Valley Riparian Pasture, BV8A in the Big Meadows Exclosure and BV2A in the Poker/Ayers Exclosure. Three of these sites (EC2B, BV8A, and BV2A), 1 unit (Stanfield Unit), and exclosures have not been grazed in recent years.

Recommendations for monitoring

While there is a strong indication that riparian plant communities are improving, the data are not statistically significant across a majority of the monitoring sites. Annual year end monitoring of bank stability at these long-term sites needs to be continued.

Status of Woody Species (Willows)

From 1994 to 1997, the woody species regeneration sampling technique described in the Intermountain Region Integrated Riparian Evaluation Guide (USDA, USFS. 1992) was used to measure willow species along the same sample site as bank stability and vegetation ecological status. From field experience, it is evident that the process is repeatable for willow species which are tree-like, having a single or relatively few stems per plant. The process is not

repeatable with any accuracy where willows are rhizomatous or have many stems per plant (Ririe. Personal communications. 1998.). Most of the willow species present in the Bear Valley Basin fit the second category. Many of the willows are of the low willow species *(Salix wolfii and Salix planifolia).* Due to their rhizomatous nature, it is extremely difficult to identify individual plants within a stand.

Data collected in the Bear Valley Basin supports these findings. Willow counts from one year to the next vary by significant amounts.

Total Numbers of Willows Counted

	1994		1995		1996		1997
	2957		1631		2843		1071
Annual Change:		-45%		+74%		-62%	

Variations from 20% to 40% are also observed when one person samples the same site on repeated occasions on the same or following days (Ririe. Personal communications. 1998.).

Conclusion

Procedures which evaluate canopy cover are more accurate for determining health and vigor of rhizomatous willow species such as *Salix wolfii and Salix planifolia* (Winward. Personal communications. 1992.) as compared to counting individual willow plants, which is highly variable and cannot be repeated with any accuracy. In 1997, a technique for rapidly sampling canopy cover was developed and tested at the long-term trend stations. This technique was modified from the Step-Point Method described in the Interagency Technical Reference for Sampling Vegetation Attributes (USDA-USDI. 1996). Field tests indicate that this method will adequately assess changes in willow cover along stream banks over time.

The Modified Step-Point Method involves making observations along a transect at specified intervals, using a nick cut in the toe of a boot as the reference point to record canopy cover "hits." The transect will be used to measure bare ground and cover by woody species, including tall and low willow species. The modified step-point method requires very little training and is simple to use when used to measure a few limited parameters. Large areas can be easily sampled within a relatively short time.

Limitations: A limitation of this method is that there can be extreme variation in the data collected among examiners when sample sizes are small. Tall or armored vegetation reduces the ability to pace in a straight line, and the offset for obstructions described in the procedures adds bias to the data collection by avoiding certain components of the community. Another limitation is that less predominant seedlings may not be hit on the transacts and therefore would not show up in the study records. This technique will be appropriate for measuring changes in canopy cover (shading) by all woody species and vigor of rhizomatous and low willow species. It may not give a good assessment of age class for seedlings or young willows. Limitations are dealt with as follows:

Two transects will be used to measure woody species cover at each long-term study site. These will be run over a minimum of 100 paces or the length of the bank stability and vegetative ecological condition samples, whichever is larger. Cover along with age class will be recorded for each woody species at each pace where the notch in the toe of the boot falls under a woody species canopy. Where notch does not come under woody species canopy and bare ground is

encountered, it will be recorded on the form. One transect will be run on each stream bank corresponding with the stream bank stability transect starting points.

Equipment: The following equipment is needed:
- V shaped notch or painted mark on the toe of the right boot approximately 1/1 6th inch wide.
- Woody Species Cover Transect Form
- Tally counter
- One stake made of 3/4 or 1 inch angle iron or similar material at least 16 inches long for marking start and end of transects.
- Hammer for pounding stakes.

Training: A minimum amount of training is needed for this method. Examiners must be able to identify woody species, including willow species, and must know how to collect canopy or foliar cover data using a notch in the boot.

Establishing Studies: The transect will start on the top of the bank at a point parallel to the beginning of the stream bank stability and vegetation ecological status transect. Pound a metal stake at this point one foot in from the edge of the stream bank. This will be repeated on both sides of the stream for both the starting and ending points. The transect will be run a minimum of 100 paces or the length of the bank stability and vegetative ecological condition transect, whichever is larger, along the stream one foot in from the location of the green line parallel to the green line on each side of the stream. Starting at the stake, take two steps (one pace) and record the cover directly below the notch or mark in the toe of the boot. Repeat for 100 paces or the length of the transect. On the field form, record each hit as follows: If there is bare soil below the notch or mark on the boot, enter a dot in the bare soil block. If the mark is under the canopy of a woody species, record the name of the species and enter a dot in the block for the appropriate age class. Finalize the transect by calculating the percentage cover for each species by age class, total cover by all woody species, and percent bare soil for the transect.

Trend comparisons may be made over time by comparing the change in cover and bare soil for the individual transacts. This data may also be used to approximate shading by woody species.

Recommendations for Monitoring

The Modified Step-Point Transect will be used for evaluating trend of woody species. These transects will be run along the same length of stream banks which are sampled at the long-term trend stations for bank stability and vegetation ecological status.

Woody Species Cover Transect Form

Date: ____________________ **Location:** ____

Transect No: ____________________ **Examiners:** ____________________________________

	Seedling/Sprout		Young/Sappling		Mature		Decadent		Dead		
Species	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**	**Total**
Totals											
Bare Ground											
Total											

Comments:

Table 9 Vegetation Ecological Status Ratings

Unit	Station	1994	1995	1996	1997
Elk Creek Riparian	EC1A	41.7	72.7	76.7	73.3
	EC1B	72.5	60.6	84.5	82.3
Stanfield	EC2A	63.5	76.1	77.8	82.2
	EC2B	85.7	79.9	91.6	68.6
Bear Valley Riparian	BV3A	34.0	62.0	82.0	87.6
	BV3B	73.5	87.2	89.8	79.7
	BV5A	105.3	83.5	96.6	72.5
	BV5B	97.6	98.2	98.3	no data
	BV6A	46.9	52.3	76.6	68.9
	BV6B	51.5	76.0	85.1	94.4
	BV7A	48.5	35.8	62.0	66.8
Big Meadows Exclosure	BV7B	62.1	77.6	55.6	81.5
	BV8A	97.5	99.2	101.8	88.9
Poker/Ayers Exclosure	BV2A	59.2	70.0	44.2	45.6
	BV2B	47.9	72.5	56.4	70.7
	BV2C	19.8	20.5	49.4	45.0
Average		63.0	70.3	76.8	73.9

Table 10 **Trend Statistics for Vegetation Ecological Status**

Unit	Station	P>F	R^2	Slope
Elk Creek Riparian	EC1A	0.22	0.61	9.88
	EC1B	0.37	0.40	5.33
Average		0.30	0.51	7.61
Stanfield	EC2A	0.07	0.86	5.78
	EC2B	0.48	0.27	***-3.96***
Average		0.28	0.57	0.91
Bear Valley Riparian	**BV3A**	**0.04**	**0.93**	**18.08**
	BV3B	0.63	0.14	2.12
	BV5A	0.24	0.58	***-8.53***
	BV5B	0.25	0.86	0.35
	BV6A	0.16	0.70	9.03
	BV6B	**0.03**	**0.93**	**13.78**
	BV7A	0.29	0.56	8.11
Average		0.23	0.67	6.13
Big Meadows Exclosure	BV7B	0.62	0.14	3.62
	BV8A	0.46	0.29	***-2.32***
Average		0.54	0.22	0.65
Poker/Ayers Exclosure	BV2A	0.30	0.50	***-6.66***
	BV2B	0.43	0.33	5.23
	BV2C	0.14	0.74	10.45
Average		0.29	0.52	3.01
All Stations Average		0.30	0.55	4.39

VIII. SUBSTRATE FINE SEDIMENT

Monitoring question: What are the trends in surface fine sediments?

Monitoring Methods, Frequency, Duration

In Bear Valley, pebble counts have been used since 1993 to estimate the percent of surface area covered by fine sediments (particles less than 6 mm in diameter). Substrate monitoring has been conducted at 46 stations in salmon/steelhead primary production habitats of Bear Valley and Elk Creeks. Much of the data has been collected at staked cross sections associated with spawning habitats within the long-term monitoring stations. These data were collected annually between 1994 and 1997. Additional samples were collected at staked cross-sections of in-season (allotment) monitoring stations in 1993, 1995, and 1996. Each station was analyzed individually to assess statistical trends in substrate fine sediments.

Findings

In Bear Valley, pebble counting has proven to be an effective quantitative technique for assessing levels of substrate fine sediments. At the staked cross section, 100 substrate particles are collected and measured. The pebble count begins at bankfull stage on one bank and proceeds to the same stage on the other side of the stream. The observer paces across the transect and collects samples one step at a time. At each step the observer reaches down to the tip of the boot and with the index finger extended, selects that particle touched by the tip (or center) of the finger. If the side of the finger touches a pebble in interspaces between particles, the sample is taken from below the interspace. Pebble counting allows sampling percent fines and particle size distribution for the entire width of the substrate. As such, finer sediments deposited in the margins of the channels are accessed and included in the sample. Outputs include percent surface fines and median particle size.

Measuring the composition of fine sediments in spawning habitats was further analyzed using the grid technique in 1997 following the protocol outlined in Overton and others (1996). There was concern that pebble counting actually underestimates substrate fines because of a sampling bias toward the first particle encountered by the observer. To evaluate this concern, a 200-intersection grid was placed on the substrate at three random locations across the pebble counting transect. After placement, this metal grid was located directly upon the substrate so that grid intersections could be associated with the size of substrate over which they lie. A plexiglass viewer was used to count grid intersections directly over fine sediments. In this way a less-biased estimate of substrate composition could be determined. The grid was placed only over potential spawning substrate and did not include measurements in the margins of the streambed.

A comparison of Grid and Wolman fines is shown for each 1997 sample site in Table 11. Wolman fines consistently exceed Grid fines at these stations. Observations on-site made it clear that much of the fine sediment was located in the margins of the channel outside the spawning zone. Thus, fine sediment levels in spawning substrate are significantly lower than fines across the entire substrate. Wolman pebble counts provided a means of estimating median particle size, unavailable in the Grid method. Median particle size provides an effective method to assess trends in substrate quality for rearing, while grid fines provides critical information to assess trends in substrate quality for spawning. Thus both techniques should continue to be used.

Conclusions

Regression analyses (JMP 1995) were used to assess trends in substrate fine sediments and median particle size at each station. Results for all 46 sites are summarized in Table 12, by grazing unit. Trend statistics include: R^2, which quantitatively describes the proportion of the variation around mean percent fines explained by time (or year) since sampling started. The probability of F (P>F) evaluates the effectiveness of the model. If the significance probability of F is small, then the model has a better fit. Observed significance probability of 0.05 or less is considered strong evidence of an effect or trend. The slope of the trend line estimates the overall rate of change in substrate fines. A negative slope indicates decline over time, and a positive slope indicates increasing trend. A significant trend in substrate fines is highlighted by a single star (*), while a significant trend in median particle size has two stars (**).

The following summarizes results of the statistical analyses:

1. Levels of fine sediment are generally decreasing through time, which means that spawning and rearing is improving. In the Bear Valley riparian pasture 13 of 14 stations show declines, and downward trends at BV-5B are statistically significant. The average slope of the regression is -4.19 which is the highest rate of decline of any unit in the Basin.

2. Median particle size is generally increasing through time, reflecting an improvement in spawning and rearing habitat. Compared to other grazing units, median particle size is increasing at a higher rate in the Bear Valley riparian pasture (slope of + .88).

Figure 5 describes the average trend in spawning substrate fines for each grazing unit in Bear Valley based on the statistical analyses. Note that all grazing units show declines in substrate fines and the relatively undisturbed reference site (at Crane Meadow) showed little or no change during the 5 year period. These data suggest that substrate conditions are improving in the salmon/steelhead spawning stream reaches associated with historically grazed riparian areas.

Recommendations for monitoring

Results of the analysis suggest that Wolman Pebble Counts and Grid measurements of surface fines should both be assessed in future monitoring. Wolman pebble counts provide an accurate estimate of trends in channel substrate composition while grid measurements provide an accurate measure of trends in the amount of fines in spawning substrates. Because fines are highly variable from year-to-year, and so important to the recovery of Chinook/steelhead productivity, we recommend sampling both parameters annually until a statistically significant trend can be established. This would add little to the monitoring program costs since the stations will be visited annually to monitor changes in greenline vegetation condition anyway.

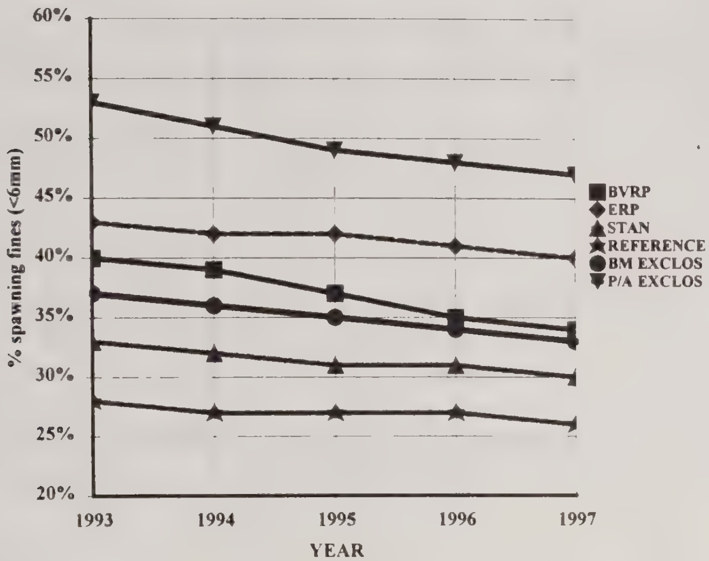
Table 11. Percent substrate fines by grid and "Wolman" techniques at monitoring stations in Bear Valley.

STATION	YEAR	% FINES GRID	% FINES WOLMAN	DIFFERENCE
BV-2A	1997	29.00%	25%	-4.00%
BV-2B	1997	32.67%	32%	-0.62%
BV-2C	1997	18.00%	24%	5.53%
BV-3A	1997	5.00%	12%	6.88%
BV-3B	1997		46%	
BV-5A	1997	16.53%	31%	14.60%
BV-5B	1997	16.50%	19%	2.37%
BV-6A	1997	20.83%	65%	44.17%
BV-6B	1997	9.33%	25%	15.44%
BV-7A	1997	36.67%	56%	19.77%
BV-7B	1997	54.17%	54%	0.20%
BV-8A	1997	13.17%	62%	48.52%
ELK-1A	1997	6.17%	24%	17.64%
ELK-1B	1997	15.00%	67%	52.24%
ELK-2A	1997	7.50%	27%	19.86%
ELK-2B	1997	6.67%	23%	15.97%
PORTER	1997	3.67%	21%	17.13%
DAGGER	1997	17.50%	31%	13.87%
FIR	1997	33.00%	33%	0.02%
UBEARSKN	1997	13.00%	44%	31.04%
AVERAGE		18.65%	36.06%	16.87%

Table 12 Trend statistics for substrate fine sediments and median particle size in Bear Valley

UNIT	STATION	% FINES			MEDIAN PARTICLE SIZE		
		R^2	P>F	Slope (% /yr)	R^2	P>F	Slope (cm/yr)
Bear Valley Riparian Pasture	BV-2C	0.4	0.37	-4	0.43	0.34	0.86
	BV-3A	0.75	0.13	-7.5	0.13	0.63	0.66
	BV-3B	0.02	0.87	-1.4	0.08	0.72	0.54
	BV-5A	0.34	0.41	-4.5	0.17	0.59	0.85
	BV-5B*	0.84	0.08	-6.1	0.28	0.47	1.09
	BV-6A	0.25	0.5	-5.4	0.26	0.49	0.22
	BV-6B	0.78	0.11	-1.3	0.66	0.19	1.05
	BV-7A	0.03	0.83	-1.6	0.03	0.82	0.11
	BV1**	0.65	0.4	-6.4	0.99	0.06	1.26
	BV2	0.38	0.58	-1.1	0.6	0.43	0.81
	BV3*	0.99	0.04	-6.1	0.3	0.63	-0.33
	BV4	0.57	0.45	0.8	0.38	0.57	0.18
	BV5**	0.53	0.48	-5.4	0.99	0.08	0.18
	BV7	0.51	0.49	-8.6	0.67	0.39	0.27
Averages		0.50	0.41	-4.19	0.43	0.45	0.55
Elk Creek Riparian Pasture	E1-A	0.69	0.17	-9.8	0.51	0.29	0.43
	E1-B	0	0.94	1	0	0.92	-0.05
	E2-B	0.35	0.41	-6.1	0.3	0.45	0.45
	ERP-1	0	0.96	0.8	0.04	0.87	0.07
	ERP-2**	0.93	0.17	-8.9	0.99	0.002	0.39
	ERP-3	0.57	0.45	2.6	0.07	0.82	0.03
	ERP-4*	0.98	0.09	-4.2	0	0.99	-0.001
	ERP-5	0.86	0.24	1.8	0.56	0.46	-0.29
	ERP-6	0.99	0.06	8.1	0.9	0.2	-0.29
Averages		0.60	0.39	-1.63	0.37	0.56	0.08
Stanfield Unit	E2-A	0.78	0.11	-5.4	0.74	0.14	0.79
	SU-1	0.34	0.62	0.5	0.16	0.73	-0.34
	SU-2	0.48	0.51	2.5	0.01	0.93	0.03
	SU-3	0.37	0.57	-1.8	0	0.97	0.02
	SU-4	0.79	0.3	-4.1	0.54	0.47	0.23
	SU-6	0.65	0.41	-3.5	0.88	0.22	0.55
Averages		0.57	0.42	-1.97	0.39	0.58	0.21
Big Meadows Exclosure	BV-7A	0.15	0.85	-1.4	0.03	0.82	0.11
	BV-7B	0.03	0.97	-0.3	0.02	0.85	0.11
	BV-8A	0.13	0.87	0.8	0.04	0.81	0.2
	BM1	0.76	0.44	-5.3	0.71	0.36	0.21
	BM1A	0.66	0.4	3.1	0.98	0.07	-0.19
	BM2	0.18	0.72	1.2	0.89	0.21	-0.38
	BM3	0.69	0.37	-4.5	0.91	0.19	0.11
	BM4	0.5	0.67	-2.8	0.1	0.79	0.14
	BM4A	0.69	0.38	-5.2	0.4	0.56	0.22
	BM5	0.83	0.27	-5.5	0.67	0.39	0.49
Averages		0.55	0.46	-2.3	0.48	0.51	0.1
Poker/ Ayers Exclosure	BV-2A	0.63	0.21	-6	0.22	0.52	0.47
	BV-2B	0.23	0.52	-7.5	0.29	0.46	0.35
	PA1	0	0.96	0.2	0.2	0.7	0.19
	PA2	0.13	0.77	4.1	0.97	0.11	-0.14
	PA3*	0.99	0.02	-10.7	0.96	0.11	1.58
	PA4	0.32	0.61	2	0.7	0.37	-0.16
Averages		0.38	0.52	-2.98	0.56	0.38	0.38
Reference Station - Crane Meadow	PR	0.07	0.73	-1.2	0.3	0.45	-0.38

Figure 5. Average trend in spawning substrate fines in Bear Valley Basin grazing units (based on site regressions).



IX. FINES BY DEPTH

<u>Monitoring question:</u> **What are the trends in depth fines?**

Monitoring Methods, Frequency, Duration

Monitoring spawning substrate conditions through analysis of depth fines has been ongoing since 1976. The monitoring program was initiated the year after the inception of the South Fork Salmon River monitoring program and utilizes the same sampling protocols. Five monitoring stations (Elk Creek at Twin Bridges, Elk Creek above Nameless Creek, Bear Valley Creek above Cub Creek, Bear Valley above Elk Creek, and Bear Valley Creek at Poker Meadows) were established in 1976 and each station consists of an upstream and downstream sampling site. Processing the core material consists of measuring particle sizes classes using the volumetric displacement of bed materials collected from the different sieves. Results are displayed as "Percent Fines", the ratio of sand and gravel materials less than 1/4 inch diameter (6.33 mm) to the total volume. Originally, ten core samples were randomly collected and analyzed from each of the five stations annually until 1981. In 1983, concurrent with high variability in SF Salmon River data, a decision was made to increase the number of samples at each of the five stations to 20 and to change the monitoring to a biennial program.

Findings

The results of the monitoring are displayed in Table 13 and Figure 6. The average percent fine values for the monitoring stations show two major distinctions that are supported with visual observations: two stations - Elk Creek at Twin Bridges and Bear Valley Creek above Elk Creek have substrates which would provide moderate to high success in embryo survival and fry emergence. The other three stations have significantly reduced potential for embryo survival and fry emergence.

The station on Bear Valley Creek above Elk Creek is located in a higher gradient reach and more valley bottom confinement than the other stations. This station has the greatest amount of materials over one inch diameter. The area of influence for the Twin Bridges station is primarily wilderness. The dominant particle size for this station is in the 1/2-1 inch diameter range.

The spawning substrate conditions for the other three stations have minimum values for fine sediment that exceed 40 percent. The Nameless Creek station is located below the confluence of Bearskin and Elk Creeks. The high sediment is likely from cumulative inputs from the Bearskin drainage and the 1992 spike is probably related to an oxbow cutoff that occurred immediately upstream during that year's spring runoff. High sediment values for the Cub Creek station are probably residual bedload from intensive dredge mining that occurred historically, upstream in the upper Big Meadows area. The Poker Meadows station is furthest downstream in the basin and represents cumulative conditions of the entire Bear Valley/Elk Creek drainage. The depositional stream reaches above this station (upstream to the confluence of Bear Valley and Elk Creeks) experienced significant channel adjustments subsequent to spring runoff in 1992.

Conclusions

Visual analysis of all data sets provide inconclusive trends. However, when combining data from 1990 to present, with recent changes in implementation of management activities within the drainage, some observable conclusions are present. An increase in percent fines in 1990 at the

Twin Bridges station may be attributed to the 1987 Deadwood Fire. Rehabilitation of the dredge mined area in Big Meadows may be the reason for reduced levels of fine sediment (42 percent) at the Cub Creek station. The increase to 60 percent in 1990 is thought to be short-term because of instream activities associated with the mine rehabilitation. In addition, fencing to exclude riparian utilization constructed in 1992 and in effect in 1993 in Big Meadows is now providing improved streambank stability which is anticipated to influence the trend positively. The subsequent trend in recovery is expected to result in long-term improvements to stream conditions.

Overall, the stations at Twin Bridges, Cub Creek, and Bear Valley above Elk Creek show current trends of declining substrate fines. These data indicate that either spawning habitat conditions are improving because recent stream improvement programs or changes in implementation of management activities are effective, or both. The data from Nameless Creek and Poker Meadows stations do not have apparent trends, and high bedloads in these downstream reaches are expected to recover at a slower rate.

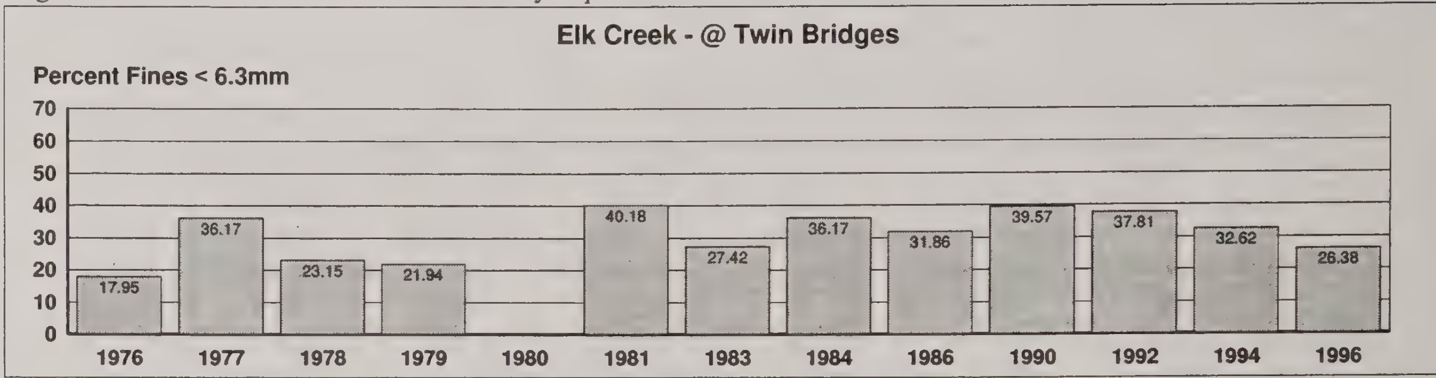
Recommendations for monitoring

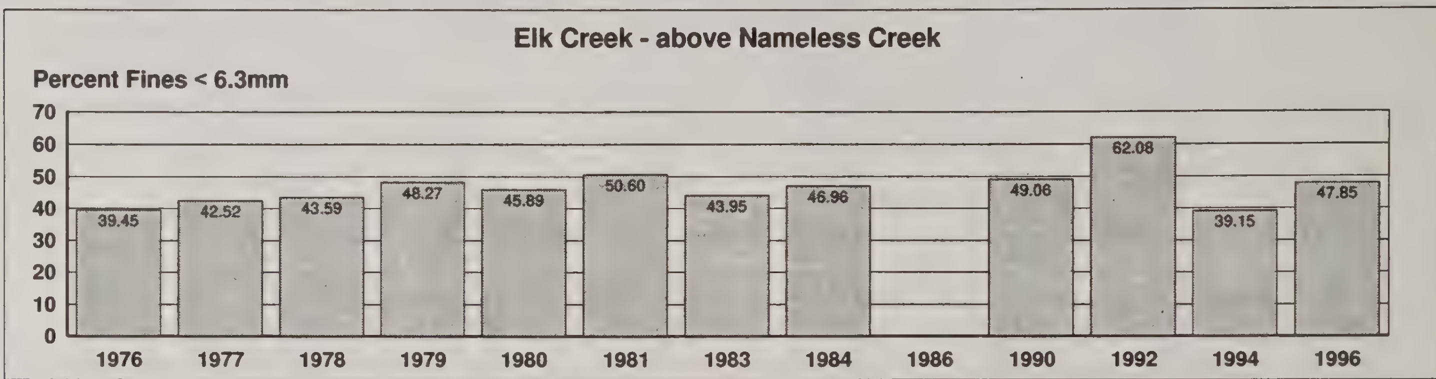
Data since 1992, indicates restoration activities and management programs may be improving spawning habitat conditions. It is recommended the biennial monitoring program be continued for 1998 and 2000 to determine if these trends are statistically significant. If the trends continue to show improvement or stay static, the monitoring program should continue, with the possibility of extending the monitoring frequency. Also, surface fine data collection at the depth fine stations needs to be investigated for a viable correlation. If a correlation is established, it may be possible the depth fine data could be extrapolated to the identified long-term monitoring stations. Otherwise, if variations in the data are visibly apparent after the year 2000, without occurrence of significant runoff events and resulting channel adjustments, the monitoring program may be discontinued.

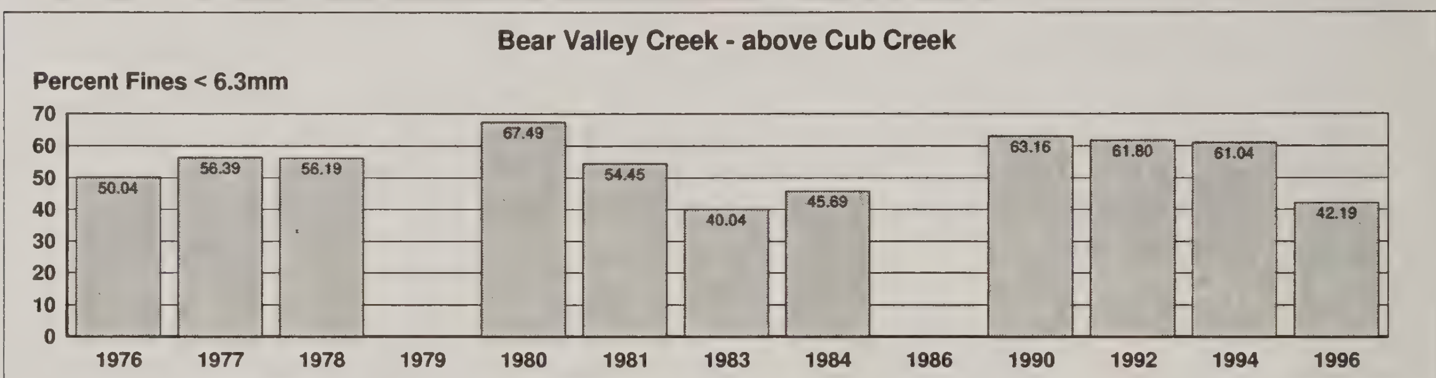
Table 13. Percent substrate fines <6.3mm by depth.

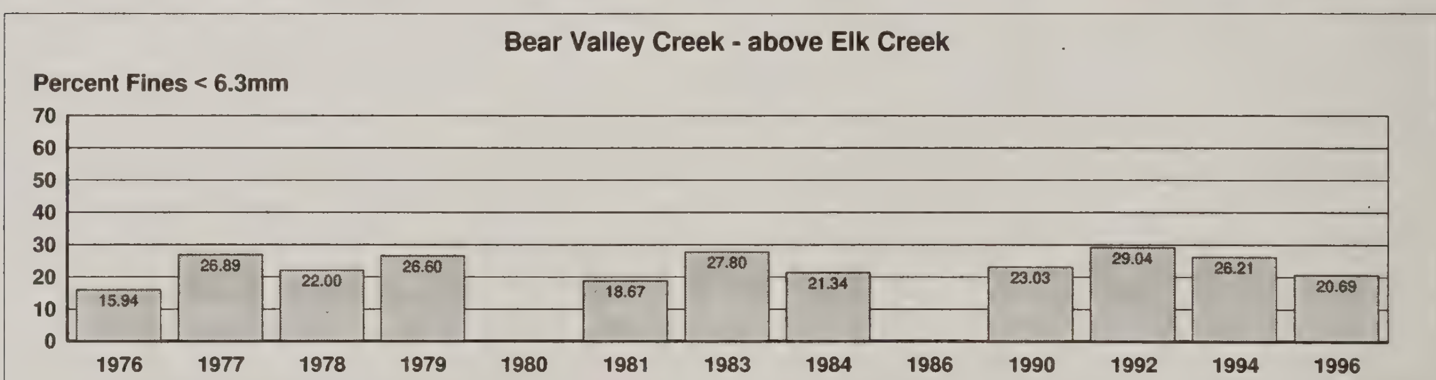
Station / Year	Elk Creek @ Twin Bridges	Elk Creek above Nameless Creek	Bear Valley Creek above Cub Creek	Bear Valley Creek above Elk Creek	Bear Valley Creek @ Poker Meadows
1976	17.95	39.45	50.04	15.94	35.81
1977	36.17	42.52	56.39	26.89	39.34
1978	23.15	43.59	56.19	22.00	38.89
1979	21.94	48.27		26.60	41.99
1980		45.89	67.49		
1981	40.18	50.60	54.45	18.67	45.23
1983	27.42	43.95	40.04	27.80	44.69
1984	36.17	46.96	45.69	21.34	40.86
1986	31.86				
1990	39.57	49.06	63.16	23.03	46.48
1992	37.81	62.08	61.80	29.04	49.85
1994	32.62	39.15	61.04	26.21	43.39
1996	26.38	47.85	42.19	20.69	48.14

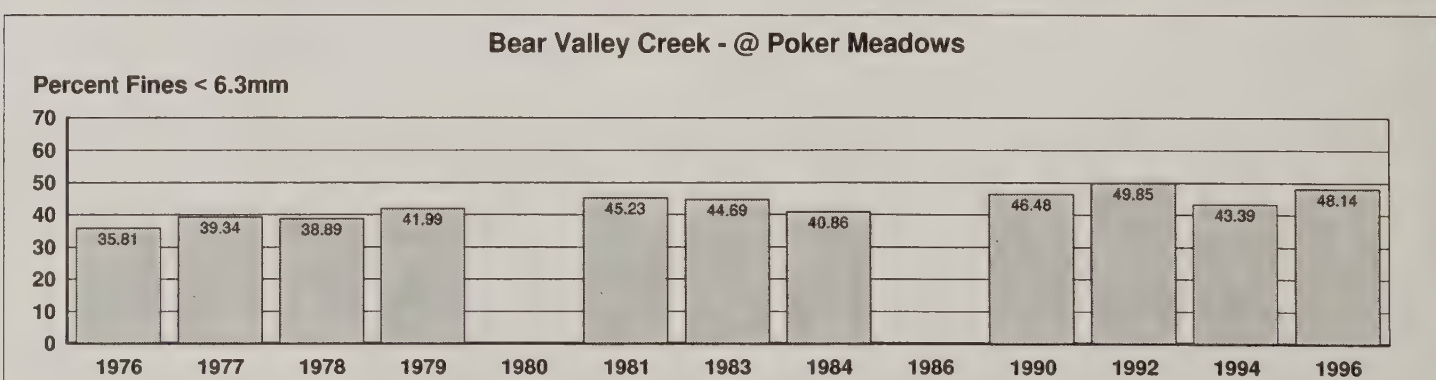
Figure 6. Percent substrate fines <6.3mm by depth.











X. POOL FREQUENCY

Monitoring question: What are the trends in pool Abundance?

Monitoring Methods, Frequency, Duration

Monitor long-term monitoring stations every 3-5 years. Protocol: Overton's large pool frequency protocol.

Findings

Table 14 contains the analysis of pool frequency by station. Fourteen of the nineteen stations monitored show a positive trend in pool frequency. Five stations show a negative trend in pool frequency. However, none of the stations showed a statistically significant trend ($f < 0.05$). Stations coming close to a statistically significant trend include Bear Valley 3a ($f = 0.0506$, slope 0.454) Bear Valley 3b ($F = 0.0515$, slope -0.468), and Bear Valley 5a ($f = 0.0550$, slope 0.305).

Conclusions

Pool frequency is an important parameter in defining fish habitat quality and stream function. However, changes in pool frequency, in the absence of a catastrophic event, usually occur over long periods of time. The more pools in any given reach, the more salmon that specific reach can support. From the data collected over the last 5 years, there is some indication of a positive trend in pool frequency, yet it is currently impossible to determine trend with any statistical reliability.

Recommendations for monitoring

Continue pool frequency monitoring as a long-term monitoring parameter and extend the monitoring frequency to 3-5 year intervals, or after a major channel altering flood.

Table 14 Pool Frequency by Station

Unit	Station	R2 Value	P>F Value	Slope(%/yr)
Bear Valley	BV-2C	0.03	0.17	0.094
Riparian	BV-3A	0.9	0.056	0.454
Pasture	BV-3B	0.899	0.05	-0.468
	BV-5A	0.89	0.055	0.305
	BV-5B	0.164	0.594	0.258
	BV-6A	0.765	0.125	0.162
	BV-6B	0.75	0.333	0.095
	BV-7A	0.429	0.345	0.237
	BV1			
	BV2			
	BV3			
	BV4			
	BV5			
	BV7			
AVERAGES		0.603375	0.216	0.142125
ELK CREEK	E1-A	0.75	0.333	0.155
RIPARIN	E1-B	0.75	0.333	0.435
PASTURE	E2-B	0.47	0.519	-0.155
AVERAGES				
BIG	BV-7B	0.85	0.077	0.468
MEADOWS	BV-8A	0.865	0.07	0.374
EXCLOSURE				
AVERAGES		0.737	0.2664	0.2554
POKER/	BV-2A	0.88	0.06	-0.475
AYERS	BV-2B	0.6	0.23	-0.138
EXCLOSURE				
AVERAGES		0.74	0.145	POOL
STANFIELD	E2-A	0.75	0.333	-0.09
UNIT				

XI. CHANNEL WIDTH/DEPTH RATIO

<u>Monitoring question:</u> **What are the trends in both pool and channel width/depth ratio?**

Monitoring Methods, Frequency, Duration

Pool width-to-depth ratio has been monitored since 1994 at the long-term monitoring stations. Pool width was measured according to the width of the water (or stream width) at the location marking maximum pool depth. It is not known how year-to-year variation in streamflow volume affects this measurement. Each year data are collected in late summer when streamflows are low, which was assumed to minimize year-to-year variation. However, pool widths may be significantly influenced by small changes in the level of stream discharge, therefore the technique was refined in 1997. Three channel profiles were permanently staked to facilitate cross-section surveys and accurate determination of water levels at the time of sampling. This refinement now allows measuring changes in both channel profile and pool width-to-depth ratio through time. Because cross-section profiles are available for just one year, we are unable to calibrate pool width/depth ratios to annual variations in water level stage. For this reason, trends in pool width/depth ratio will be analyzed as in past years.

Findings

Table 15 summarizes trend statistics for average channel and pool width-to-depth ratios for the long-term monitoring stations. Trends in width-to-depth ratio are generally insignificant. Overall mean R^2 for channel width/depth and pool width/depth ratio were 0.37 and 0.40 respectively. Average slope of the regression lines was: -0.69 (channel W/D ratio), and -0.45 (pool W/D ratio). The negative slope suggests that channels and pools are narrowing and/or deepening slightly, which is an improvement in aquatic habitat for fish. Significant improving trends were observed at BV2A and BV2C, in the Poker/Ayers exclosure, BV5B and BV6B in the Bear Valley riparian pasture, and E2B in the Stanfield Unit. The lack of a clear trend in overall channel width-to-depth ratio might be due to the fact that water level stage was not annually calibrated. The establishment of cross-section profiles in 1997 and future monitoring of this parameter will provide water level stage information needed to make the appropriate adjustments.

Recommendations for monitoring

Measure bankfull and water width-to-depth ratios at the transects established in 1997. Continue to monitor width/depth ratios as in the past (at each habitat unit) to establish correlation to width/depth ratios at the staked cross-sections and extrapolate the cross-sectional data to earlier observations. Width/depth ratios are not highly variable through time, and change is gradual. For this reason, data should collected on a 3 to 5 year frequency. However calibrating width/depth ratios to cross-section data will require several repeat years of sampling. It is recommended that cross-sectional profiles and width/depth ratios be monitored annually until a regression can be established, and then shift to monitoring every 3-5 years.

Table 15 Trend statistics for average channel and pool width ratios at Long Term Monitoring stations

Stations	Width/Average Depth			Width/Maximum Depth		
	F	R^2	Slope	F	R^2	Slope
BV2A	0.73	0.08	2.6	0.05*	0.9	-3.49
BV2B	0.08	0.85	-12.8	0.36	0.41	-3.4
BV2C	0.05*	0.9	8.6	0.78	0.05	-0.35
PA Exclosure	**0.27**	**0.61**	**-0.53**	**0.38**	**0.45**	**-2.41**
BV3A	0.63	0.13	-2.5	0.23	0.6	0.93
BV3B	0.55	0.2	3.7	0.16	0.7	1
BV5A	0.75	0.06	-1.3	0.83	0.03	0.11
BV5B	0.06*	0.88	-22.4	0.05*	0.9	-1.2
BV6A	0.09	0.83	2.5	0.96	0.01	0.02
BV6B	0.06*	0.87	-1.9	0.59	0.17	-1.1
BV7A	0.85	0.02	-0.93	0.85	0.02	0.17
BV Rip Past	**0.41**	**0.43**	**-3.26**	**0.52**	**0.35**	**-0.01**
BV7B	0.88	0.02	1	0.87	0.02	0.13
BV8A	0.5	0.25	-2.8	0.43	0.32	0.4
BM Exclosure	**0.69**	**0.14**	**-0.90**	**0.65**	**0.17**	**0.27**
E1A	0.08	0.84	6.6	0.48	0.27	-0.97
E1B	0.8	0.04	2.4	0.35	0.42	1.8
Elk Rip Past	**0.44**	**0.44**	**4.50**	**0.42**	**0.35**	**0.42**
E2A	0.64	0.13	1.6	0.13	0.76	-0.4
E2B	0.83	0.03	0.3	0.1	0.81	-0.82
Stanfield past	**0.74**	**0.08**	**0.95**	**0.12**	**0.79**	**-0.61**
All stations:	**0.47**	**0.37**	**-0.69**	**0.44**	**0.40**	**-0.45**

XII PHOTOGRAPHS

Monitoring question: What are the trends in visual indicators?

Monitoring Methods, Frequency, Duration

Photographs have been taken since 1992 at the allotment compliance monitoring stations. There are 51 monitoring stations established on primary production (mainstem) and their tributaries on the Bear Valley, Elk Creek, and Deer Creek allotments. The paired photographs were taken between 1992 and 1997.

Findings

The paired photographs displayed in the following section were taken within these pastures and grazing units of the three Bear Valley Basin allotments:

- Bear Valley C&H Allotment
  - Bear Valley Riparian Pasture
    - Primary Production
  - Bruce Meadows/Sheep Trail Unit
    - Tributary (ungrazed exclosure)
  - Big Meadows/Cache Creek Unit
    - Primary Production (ungrazed exclosure)
- Elk Creek C&H Allotment
  - Elk Creek Riparian Pasture
    - Primary Production
    - Tributary
  - Stanfield Unit
    - Primary Production
- Deer Creek C&H Allotment
  - Tributary

Parameters observed in these photographs include substrate, sand bars, gravel bars, fines, bank stability, vegetative cover, vegetative species composition, encroachment of vegetation, substrate vegetation, pools, channel width, undercut banks, shade, willow composition, and community types. Observations and interpretations were made separately by several individuals of different resource backgrounds. The summaries of the paired photographs contain the comments that appeared consistently among the individuals. Observations varied between very little change in some paired photographs to significant changes in other paired photographs.

Conclusions

Photographs are an excellent monitoring tool to use in observing change in resource conditions, especially in combination with other monitoring parameters.

Recommendations for Monitoring

Establish photo points at station monuments and selected point bars at the long-term monitoring stations. Re-take photo points of a selected group already established at the allotment compliance monitoring stations. Follow correct procedures for establishing photo points to assure

consistency when re-taking photographs. Attempt to take photographs at approximately the same time of year. Over time, photographs may be able to replace some of the more time-consuming monitoring procedures.

BV-6
(DS-RB)

6/28
1993

Observation and interpretation of changes between 1993 and 1996 Photos

Aquatic/riparian vegetation (Carex community) is more extensive; Sandbar is building and strongly revegetating as evidenced by the encroachment of of the bank and vegetation into the channel (Note the distance between the post and the water line); and Improvement in the streambank stability.

BV-6
(DS-RB)

7/16
1996

BV-6
(US-RB)

6/14
1994

Observation and interpretation of changes between 1994 and 1996 Photos

Natural log in the 1994 picture has washed away; Sandbar appears to be receding and a deepening of the stream channel; Downstream banks seem to be improving in stability; Improvement of aquatic/riparian vegetation and Encroachment of vegetation on to the sandbar.

BV-6
(US-RB)

7/16
1996

BM-4A
(US-LB)

6/29
1993

Observation and interpretation of changes between 1993 and 1997 Photos

New riffle, gravel bar and pool along opposite bank suggests increasing habitat diversity from changes in scour and deposition; Stream appears to be moving from a glide to a pool riffle; Streambed is stabilizing and there is a deepening of the stream channel; Improvement in vegetative cover and streambank stability.

BM-4A
(US-LB)

9/15
1997

BEAR VALLEY BASIN - BEAR VALLEY CREEK
BEAR VALLEY C&H ALLOTMENT
BIG MEADOWS - CACHE CREEK UNIT

BM-5
(US-RB)

6/29
1993

Observation and interpretation of changes between 1993 and 1997 Photos

Depositional bar has become an undercut bank; Increased stability of the streambank; Improvement in the aquatic/riparian vegetative condition; and Vegetation is building out on the streambank.

BM-5 US-R 7/9/97

BM-5
(US-RB)

7/9
1997

BEAR VALLEY BASIN - ELK CREEK
ELK CREEK C&H ALLOTMENT
STANFIELD UNIT

SU-1
(DS-RB)

6/30
1993

Observation and interpretation of changes between 1993 and 1996 Photos

Substrate appears to be a coarser material; Bar is scoured; Nature of the bar material has changed from sand to gravel; Narrowing of the stream channel; Increased vegetative cover on the bank and bar; and Significant increase of aquatic/riparian vegetation on the bar.

SU-1
(DS-RB)

7/25
1996

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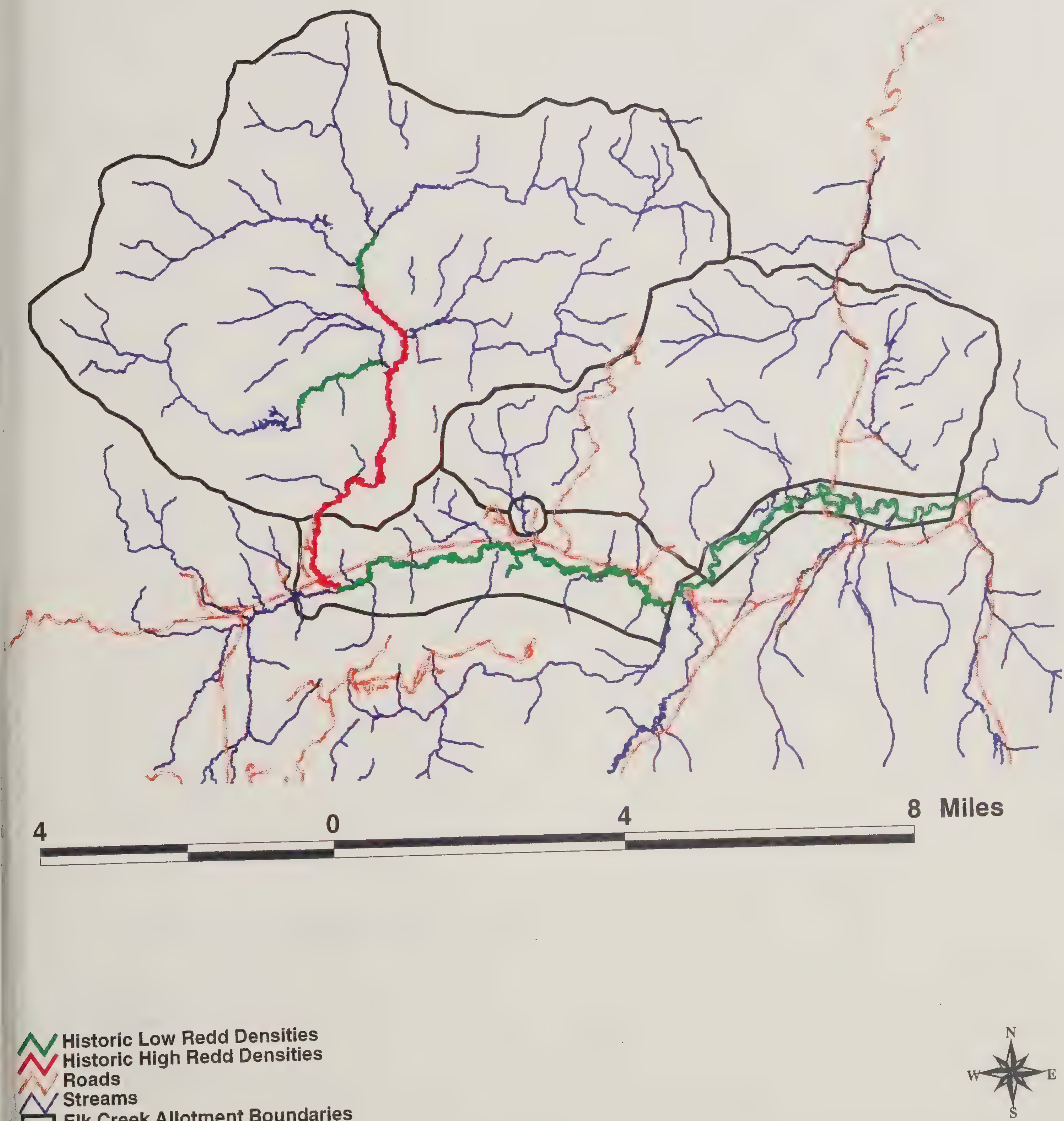
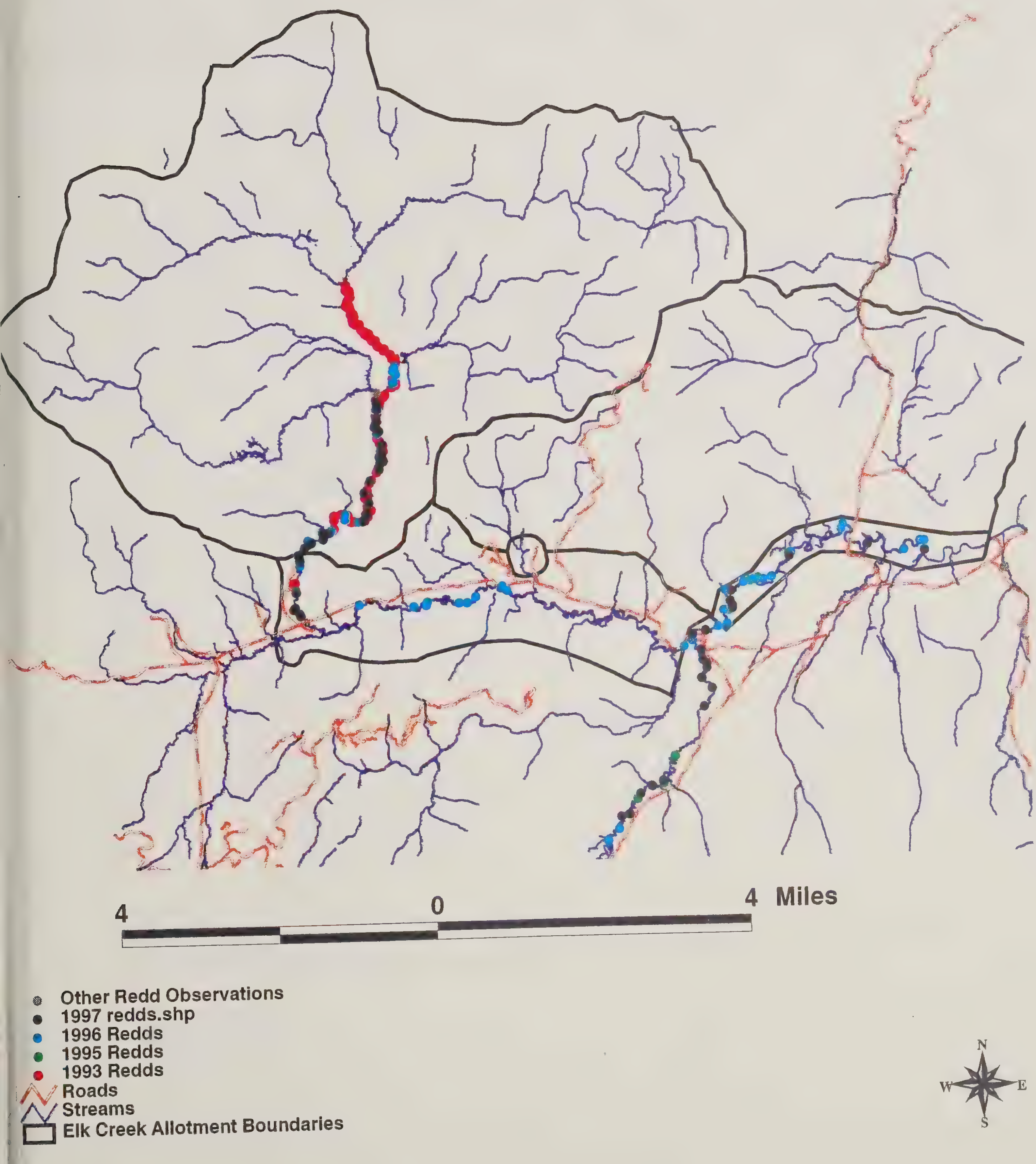
XIV MAPS

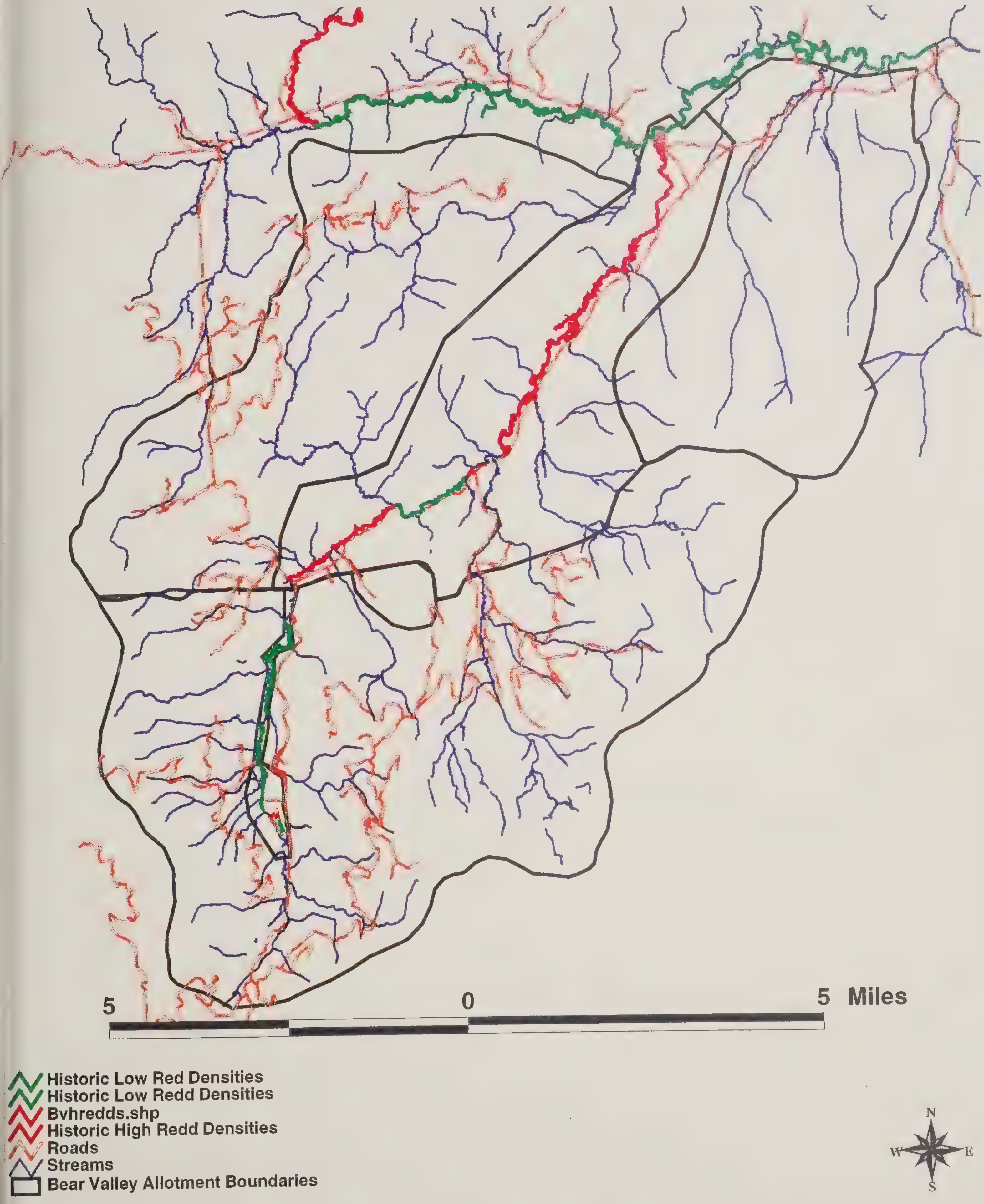
Map #1: Historic Locations Of Redds Within the Elk CreekAllotment



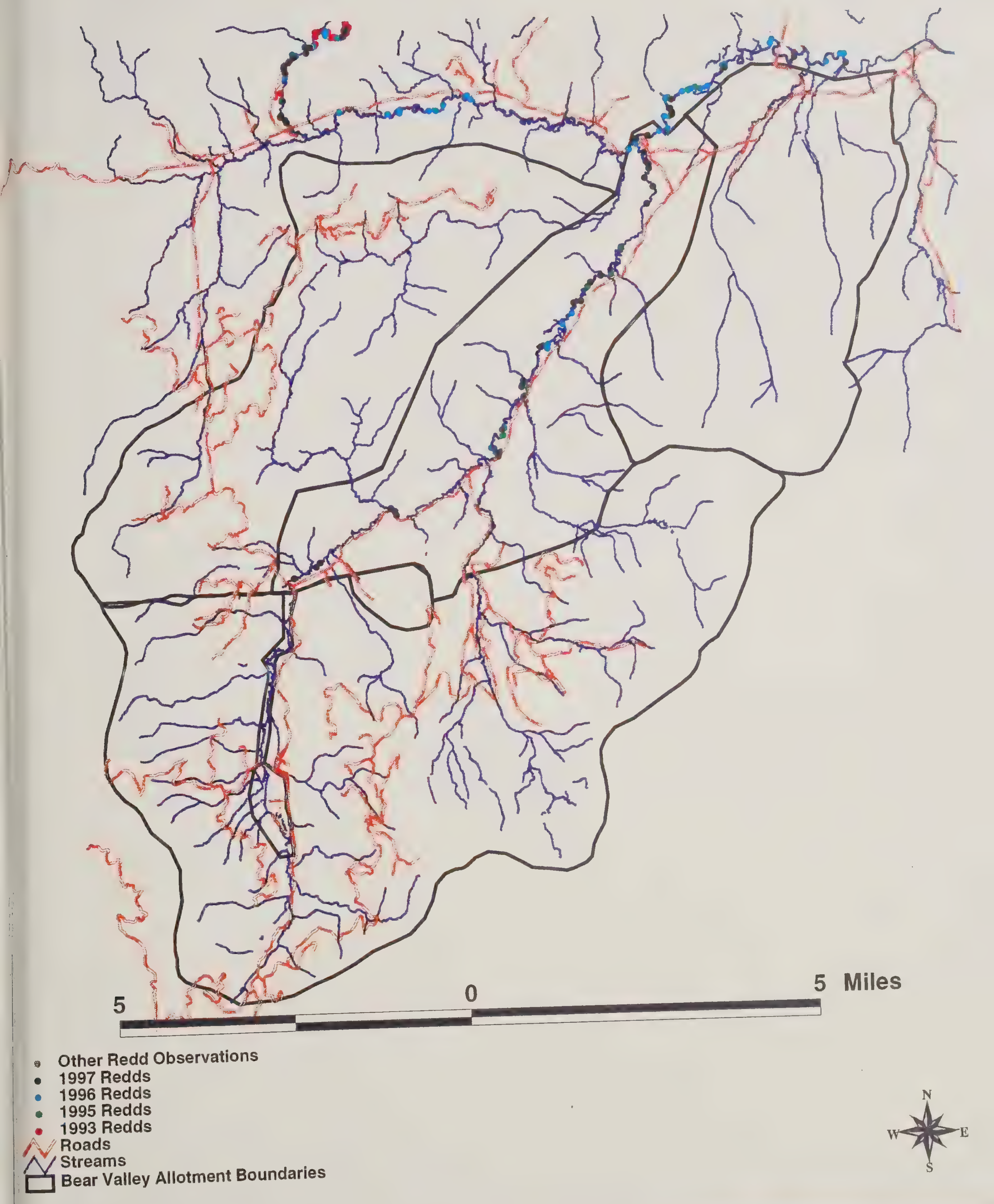
Map #2: Lcation of Chinook Redds Within The Elk Creek Allotment



Map #3: Historic Location of Redds within the Bear Valley Allotment



Map #4: Location of Chinook Redds Within the Bear Valley Allotment



APPENDIX A

Bear Valley Collaboration Group

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